Concrete

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Design of Concrete Mixtures

A Practical Method of Designing Quality Concrete—Tables—Charts—Typical Problems

By PAUL E. KRESSLY
Consulting Engineer, Los Angeles, Calif.

THE development of the technic of concrete proportioning in recent years has brought to those engaged in the design, inspection and construction of concrete work a vast amount of literature on the subject. Much of it has been admirable in spots and contained just enough indefinite, debatable matter as to make it very confusing to those directly interested in results. The average engineer, and particularly the inspector or contractor, care little or nothing about the underlying theories of concrete design but do want practical data in the simplest form for use. Most of them wish to know correctly and understand concrete without becoming hopelessly enmeshed in the intricacies of divergent current theories, or be required to memorize rules and formulas.

To overcome this objection, tables and diagrams, together with illustrations and examples for their use, have been prepared from data based upon many thousands of concrete mixtures and tests of concrete used in many engineering structures of a variety of types, as well as from numerous special tests covering a period of eight years. These tables and diagrams introduce important simplifications in the design of concrete mixtures and anyone who has an understanding of the fundamental principles of concrete design should experience no difficulty in the proper use thereof.

The use of the tables and diagrams makes it practical to design mixtures so that the physical properties of concrete can be predicted with considerable accuracy at the time of fabrication provided the fundamental requirements of concrete are observed, namely, that the proper materials are selected, that the mixing, placing and curing of the concrete is properly done, and that the mixture has proper workability.

The quality of concrete is influenced to a marked degree by the character of the aggregates and variations in the physical properties of cement, even though it meets the A. S. T. M. Specifications; so will improper methods of mixing and placing the concrete, and improper and inadequate curing. This imposes severe restrictions on the manufacture of the concrete, for unless each step is carefully carried out, the finished product will probably not meet the requirements of the work.

Particular emphasis should be placed on the importance of making actual tests of trial mixtures composed of the materials proposed to be used in the concrete work. If these tests are lower than the requirements, make tests of trial mixtures of the same design of mix as before but substitute another brand of cement, sand or gravel. By introducing only one variable in each set of tests it is possible to determine which material or materials, if any, cause the reduction in strength.

It is not intended to convey the impression that the design of the concrete mixture should be based on strength alone unless strength is the only consideration. Different conditions of service require concretes possessing different properties, as, for instance, compressive or flexural strength may be wanted, or water-tightness, resistance to wear or weathering. A concrete may possess all of these properties to a high degree, but again one or more may be almost entirely absent and the presence of one is no guarantee of the presence of any other. If qualities other than strength are required, then the mixture should be designed to insure that the concrete has these desired properties. In general, high strength concrete possesses all of the essential properties.

According to our record of tests of concrete mixtures where the concrete failed to come up to the required strength, the cause in 9 per cent of the tests was due to coarse aggregate, 13 per cent to both the sand and cement, 33 per cent to sand and 45 per cent to cement.

Whenever fine aggregate is referred to or mentioned herein it denotes material graded from 0 to ⅜ in., and whenever coarse aggregate is mentioned it denotes material graded from ⅜ in. to maximum size, unless otherwise specified.

Proportioning Aggregates

The purpose of proportioning, as applied to aggregates, is to obtain the same volume of solids or absolute volume of material in each batch. With granular materials the same measured volumes do not necessarily give the same absolute volumes, for the solids in the measured volume depend upon the method of filling the containers, the grading of the aggregates, or in the case of fine aggregates, on the moisture content. Thus any volumetric method of measuring aggregate, no matter how carefully used, is liable to errors from the above mentioned sources.

Studies show that considerable changes in volume can result when moisture is present in the fine aggregate. The unavoidable variations in filling the containers even in a proportioning plant operated under the best of conditions, as well as variations in the grading of aggregate, may cause probable errors equally as great as those due to changes in moisture content.

Proportioning by weight seems to be the only method whereby these errors can be largely eliminated, for since the specific gravity of an aggregate is practically a constant its weight varies directly as the volume of its solids, and the errors of proportioning are those due mainly to balancing the scales and to moisture contained in the aggregate. With a properly operated weighing plant the former are very small and ordinarily do not exceed a fraction of one per cent, while the latter, unless absolutely ignored, causes errors of less than one per cent.

General Rules Relating to the Combination of Aggregates

(1) For a constant fineness modulus of mixed aggregate, and fine aggregate, the percentage of fine aggregate in the mix increases as the fineness modulus of the coarse aggregate increases.

(2) For a constant fineness modulus of mixed aggregate and coarse aggregate, the percentage of fine aggregate in the mix increases as the fineness modulus of the fine aggregate increases.

(3) For a constant fineness modulus of fine and coarse aggregate, the percentage of fine aggregate in the mix increases as the fineness modulus of the mixed aggregate decreases.

Steps in the Design of Concrete Mixtures

1. Knowing the type of work for which the concrete is to be designed, determine by reference to Table 1, the consistency recommended for this class of structure.

2. Having decided upon the strength of the concrete required, determine by reference to Table 3, the quantity of cement per cubic yard of concrete in place and the size and grading of aggregate that may be used for the corresponding consistency, which will give the desired strength.

3. From Table 4, determine the range of fineness modulus of mixed aggregate that may be used with the quantity of cement per cubic yard of concrete in place and the size and grading of mixed aggregate previously determined.

4. From Table 5 ascertain if the maximum permissible fineness modulus of mixed aggregate must be reduced for the class of work to be done and kind of aggregate to be used in the concrete.

5. Having determined the minimum and maximum permissible fineness moduli of mixed aggregate, select a fineness modulus within this range.

6. Knowing the quantity of cement per cubic yard of concrete in place, fineness modulus of mixed aggregate and relative consistency, determine by reference to diagram 1, the water-cement ratio and quantity of water corresponding to these known values.

7. From Table 7, ascertain the weight of dry aggregate corresponding to the water-cement ratio and the quantity of cement per cubic yard of concrete in place previously determined.

8. Knowing the fineness modulus of mixed aggregate and of the fine and coarse aggregates, determine from either Diagram 2, 3, 4 or 5, depending upon the size and grading of mixed aggregate, the percentages of fine and coarse aggregate corresponding to the fineness modulus of mixed aggregate.

9. Knowing the total weight of dry mixed aggregate required to each bag of cement, ascertain the weights of fine and coarse aggregate from the percentages previously determined.

10. To determine the weights of moist or wet fine and coarse aggregate to be used in the mix, ascertain the weight of free water contained in fine and coarse aggregate separately and add the respective weights of free water in each aggregate to the respective weights of dry fine and coarse aggregate previously determined.

11. To determine the volume of water required in the mix when using moist or wet aggregate, deduct from the required volume of water per bag of cement previously determined, the volume of free water contained in the total weight of aggregate required to each bag of cement.

TABLE NO. 1

The consistency recommended for various classes of engineering structures is as follows:

ROADS AND PAVEMENTS	
Machine finishing	100-105
Hand tamping	105-110
REINFORCED CONCRETE	
Heavy sections	105-110
Thin vertical sections	115-120
Thin confined horizontal sections	120-125
MASS CONCRETE	105-110

TABLE NO. 2

The slump in inches of freshly mixed concrete made by using a tube having an inside diameter of 8 in. at the base and of 4 in. at the top and a perpendicular height of 12 in., for various relative consistencies is approximately as follows:

Relative Consistency	Slump in inches
100	1
105	1½
110	2½
115	4
120	5
125	6

TABLE NO. 3

ULTIMATE VALUES OF FLEXURAL (MODULUS OF RUPTURE) AND COMPRESSIVE STRENGTHS IN POUNDS PER SQUARE INCH AT AGE OF 28 DAYS FOR VARIOUS CONCRETE MIXTURES RECOMMENDED TO BE USED IN THE DESIGN ON ENGINEERING STRUCTURES

For minimum and maximum values of fineness moduli of mixed aggregate practical to use for various concrete mixes and size and grading of mixed aggregate see Table 4.

Bags of cement per cu. yard of concrete in place	Size and grading of mixed aggregate	Relative Consistency 100		Relative Consistency 110		Relative Consistency 120	
		Flexural strength lbs. per sq. in.	Compressive strength lbs. per sq. in.	Flexural strength lbs. per sq. in.	Compressive strength lbs. per sq. in.	Flexural strength lbs. per sq. in.	Compressive strength lbs. per sq. in.
4	0 to 2"	375	2000	350	1600	320	1300
4	0 to 3"	350	1800	325	1400	300	1100
4½	0 to 2"	475	3000	450	2500	400	2200
4½	0 to 3"	450	2500	425	2000	375	1700
5	0 to 2"	575	4000	540	3500	500	3000
5	0 to 3"	550	3500	520	3000	470	2600
5½	0 to 2"	600	4200	570	3700	510	3200
5½	0 to 3"	575	4000	540	3500	500	3000
6	0 to 1"	700	5000	660	4500	600	4000
6	0 to 1½"	650	4500	610	4000	560	3500
6	0 to 2"	625	4300	590	3800	530	3400
6	0 to 3"	600	4200	570	3700	510	3200

The values of flexural and compressive strengths in the above table are based upon strengths at or below the minimum strengths obtained by actual tests.

Flexural strength tests made of concrete mixtures for gradings of 0 to 2 in. and 0 to 3 in. and using more than six bags of cement per cubic yard of concrete in place showed no increase in strength and are therefore omitted from the table

For high strength concrete the best quality of cement and aggregates must be used and proper care taken in proportioning and mixing the respective materials and in placing and curing the concrete.

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Mixing Time and Products Plant Economy

Presenting the Findings of a Series of Time of Mixing Tests Conducted at Pittsburgh and Omaha

By E. GRANT LANTZ

DURING the early years of the concrete products industry it was not uncommon to mix the materials dry for two or three revolutions of the blades and then wet for perhaps fifteen or twenty seconds. This may be an extreme case but now the pendulum has swung and perhaps to another extreme for it is not now uncommon for products manufacturers to mix for fifteen or twenty minutes.

Long time mixing requires a heavy investment in mixers and motors. Power costs rise, the mixers wear out faster, in fact, the cost of practically every item, with the exception of labor, associated with the operation and maintenance of the mixer is increased. Is this additional expense worth while, can a saving in materials be made, can the strength of the concrete be increased?

Two series of time of mixing tests are presented as being an indication of the relative value of short and long time mixing. There are many variables to be investigated before the question can be answered but these tests are a strong indication that a moderate time of mixing may be more economical than either the extremely long or extremely short mixing periods.

The Pittsburgh tests were made at the Iron City Brick and Stone Company and the units tested at the Pittsburgh Testing Laboratory. The specimens were made under regular plant operating conditions, the only departure was that the materials were proportioned and the consistency controlled by the engineers in charge. The mixer was of the batch type with revolving paddles. The block machine was of the stripper type with mechanical tampers making standard 8- by 8- by 16-inch hollow block. The temperature of the curing room was about 90 deg. F.

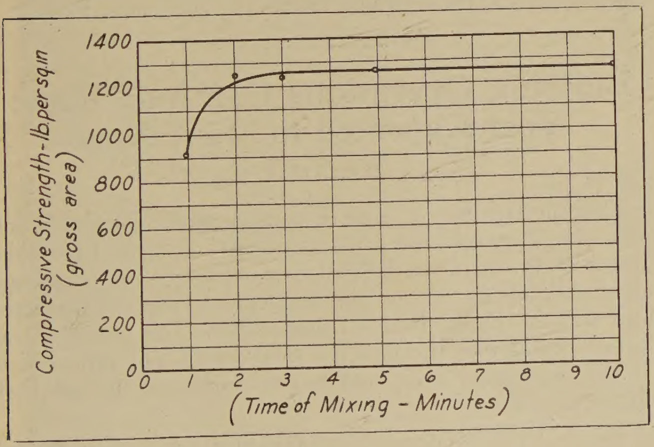


Figure 1

The results of this series are given in Table 1 and Fig. 1. One minute mixing (mix 1:5) produced block having only 911 lbs. strength per sq. in. (gross section) while under the same conditions two minutes mixing produced block of 1243 lb. strength, a gain of 30 per cent. Ten minute mixing shows an increase of less than 2 per cent over two minute mixing. Will this increase pay for the additional mixing costs?

The Omaha tests were made at the Omaha Concrete Stone Co. and the units broken at the Omaha Testing Laboratory. No change was made in the plant personnel except that the materials were proportioned by the engineers in charge of the tests. The mixer was of the batch type with revolving paddles. The block machine was of the stripper type, with four full-width tamper feet making standard 8- by 8- by 16-inch hollow block. An average temperature of 95 deg. F. was maintained in the curing rooms.

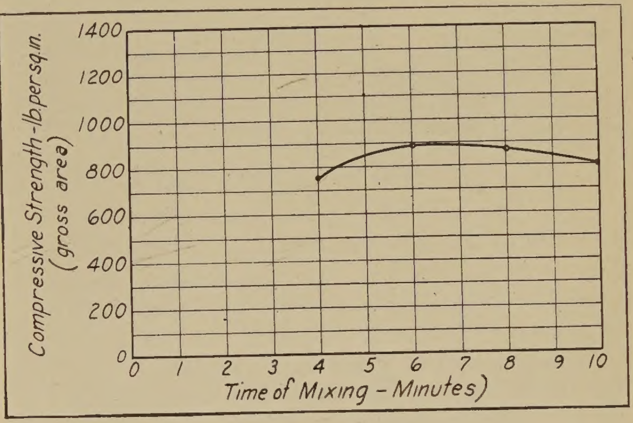


Figure 2

The results of this series are given in Table 2 and Fig. 2. All batches were mixed dry for 2 minutes before the water was added. A total mixing time less than 4 minutes (2 minutes dry and 2 minutes wet) was not used because shorter mixing times produced concrete more rapidly than it could be used in the machines.

Two minutes of dry followed by 2 minutes of wet mixing (mix 1:7) produced block having a strength of 757 lbs. per sq. in. of gross area. The series for three minutes wet mixing is high, based on the variable cement content series. The maximum strength, 885 lbs., was produced with 4 minutes of wet mixing. With 8 minutes of wet mixing the strength decreased about 10 per cent from the maximum.

Different results may be obtained from tests using other types of aggregate. The design of the drum, spiral blades, paddles, speed of rotation, grading of the aggregate, moisture content of the aggregate and size of the batch are other factors which may affect the final result.

The question of mixing time should be considered from the viewpoint of producing a quality unit at minimum costs. While the Pittsburgh and Omaha tests are not conclusive they indicate that there is an economical limit to the time the manufacturer can spend on mixing—the increase in strength becomes less prominent, the cost keeps mounting.

TESTS OF CONCRETE BLOCK

Pittsburgh, Pa., October-November, 1924

TABLE 1.—*Effect of Time of Mixing on Compressive Strength*

Compression tests of 8- by 8- by 16-in. building block.
Aggregate, Ohio River sand 3/16-in. and Ohio River pebbles ¼-¾-in.
Fineness modulus of mixed aggregate, 4.00.
Mix 1:5 by volume of dry rodded aggregate.
Machine mixed concrete.
All batches mixed dry while mixer blades made four revolutions and to time shown after water was added.
Number of tamps uniform but not constant.
Curing, 15 hours in steam, remainder until test in air.
Age at test, 28 days.
Blocks per sack of cement about 14.
Each value is the average of 4 specimens, 2 each from 2 batches made on different days.

Time of Mixing Min.	Compressive Strength—Lbs. per Sq. In. (Gross Area)
1	911
2	1243
3	1238
5	1263
10	1265

TESTS OF CONCRETE BLOCK

Omaha, Neb., August-September, 1926

TABLE 2.—*Effect of Variation in Time of Mix*

Tests of 8- by 8- by 16-in. concrete building block.
Aggregate—Platte River sand (0-No. 4); gravel (No. 14, ¾-in.)
Fineness modulus of mixed aggregate, 3.9.
Mix 1:7 by volume dry and rodded aggregate.
Machine mixed concrete.
Time of mixing shown includes 2 minutes of dry mixing.
Number of tamps each of 4 ft.—14.
Curing: 48 hours in steam, remainder in air.
Age at test, 28 days.
Water-cement ratio, 0.98.
Blocks per sack of cement, 22.
Each value of strength is the average of three tests, and of absorption, two tests.

	Time of Mixing	Compressive Strength Lbs. per Sq. In.		Absorption Per Cent by Dry Weight	
Ref.	Min.	Gross Area	Net Area	24 Hr.	48 Hr.
10	4	757	1235	3.64	3.64
1	5	1068*	1743	2.80	3.62
11	6	885	1442	3.35	3.63
12	8	867	1413	3.37	3.66
13	10	795	1298	3.33	3.33

*Value probably high by comparison Table 2 and Figure 2.

Illinois Leads in Production and Use of Manhole and Catch Basin Block

A survey recently made by the Cement Products Bureau of the Portland Cement Association indicates that about 75 per cent of the concrete manhole and catch basin block manufactured in the United States each year are produced and used in Illinois. In addition to Chicago, where over 5,000,000 units are used annually, the Illinois municipalities which use manhole block are as follows:

Addison, Argo, Arlington Heights, Aurora, Bellwood, Berkely, Berwyn, Blue Island, Broadview, Brookfield, Calumet City, Chicago Heights, Cicero, Clearing, Decatur, Deerfield, Des Plaines, Dolton, Downers Grove, Elmhurst, Elmwood Park, Evanston, Forest View, Franklin Park, Glencoe, Glen Ellyn, Hazelcrest, Harvey, Highland Park, Hinsdale, Ivanhoe, LaGrange, LaGrange Park, Lansing, Libertyville, Lombard, Lyons, Markham, Melrose Park, Morton Grove, Mount Prospect, Mount Pleasant, Mundelein, Niles Center, North Riverside, Peoria, Richmond, Riverdale, River Grove, Riverside, Rockford, Roselle, Schiller Park, South Elgin, South Holland, Specialville, Steger, Stickney, Summitt, Tessville, Thornton, Villa Park, Waukegan, Westchester, Western Springs, Westmont, Wheaton, Wilmette and Winnetka.

The Sanitary District of Chicago, which does considerable sewer work each year, also uses many manhole block.

Other municipalities that build sewer appurtenances of concrete block are listed here by states:

California—Palo Alto.

Connecticut—Bridgeport.

Indiana—Crown Point, East Gary, Gary, Hammond, Hobart, Logansport, Michigan City, Munster, North Manchester, Rensselaer, Richmond and Terre Haute.

Iowa—Clear Lake, Correctionville, Des Moines, Dow City, Fort Dodge, Hinton, Marion, Mason City, Newton, Sioux Rapids, Spencer and Waterloo.

Massachusetts—Cambridge, Danvers, Leominster, New Bedford and Peabody.

Michigan—Caspian and Kalamazoo.

Minnesota—Duluth, Faribault, Jordan, Mabel, Mankato, North St. Paul, Pelican Rapids, St. Paul, Wanamingo and Waseca.

Missouri—Moberly.

Ohio—Cincinnati.

South Dakota—Sioux Falls.

Tennessee—Chattanooga.

Vermont—Burlington.

Washington — Bellingham, Everett, Marysville and Seattle.

Wisconsin — Delavan, Kenosha, Milwaukee, Mount Horeb, Phillips, Racine, Waukesha and Wauwatosa.

In British Columbia, the city of Vancouver also uses concrete block for building manholes and catch basins.

Building Operations Continue Pace; Year Expected to Make New Record

That the October volume of construction, contracted for or under way, was the greatest of any on record for that month is agreed upon by two sources furnishing statistics on this subject, namely, the Associated General Contractors and the F. W. Dodge Corporation. The latter, in its report, states that the month's total was 3 per cent ahead of the September total and 6 per cent over the total of October, 1927.

The A. G. C. predicts the establishment of a new record for volume of activities for the year. The statistics, covering all types of construction and based upon actual shipments of materials, according to this source, show the total for the first 10 months of this year to be more than 4 per cent greater than the figure for the corresponding period in 1927.

Value of construction operations of all types handled during 1928 will reach or pass beyond the eight billion dollar mark, it is stated.

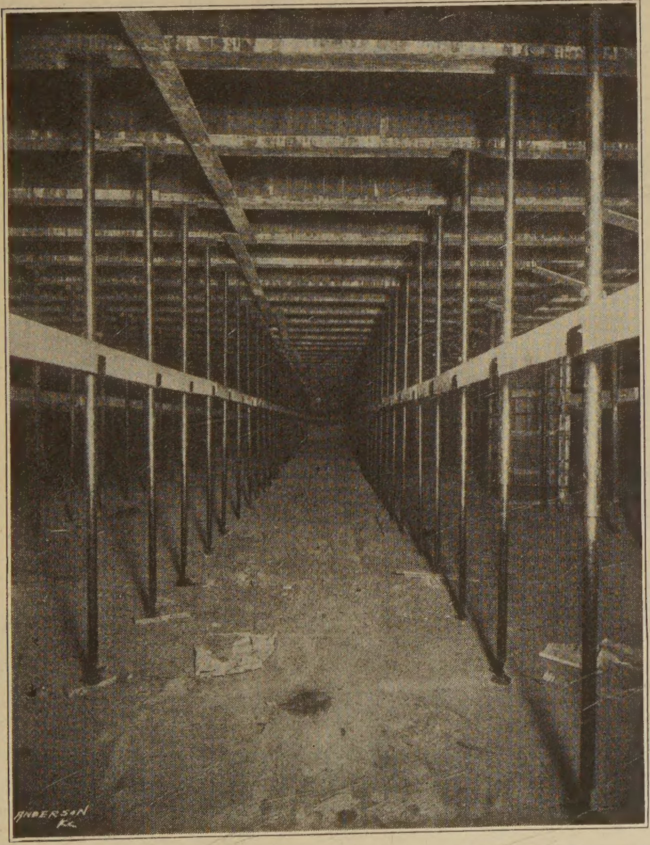
Form Work for Modern Light-Weight Floor Construction

Material Used, Form and Shore Erection, and Costs Observed on Middle Western Jobs

THROUGHOUT the Middle West various types of structures, both reinforced concrete and steel construction, are being designed with light-weight concrete floors of ample strength. This construction is that known to architects, engineers, and contractors as joisted or "tin pan" floors. The growing popularity of this type of floor construction requires that an increasing number of designers and builders familiarize themselves with the methods most successfully used in their erection.

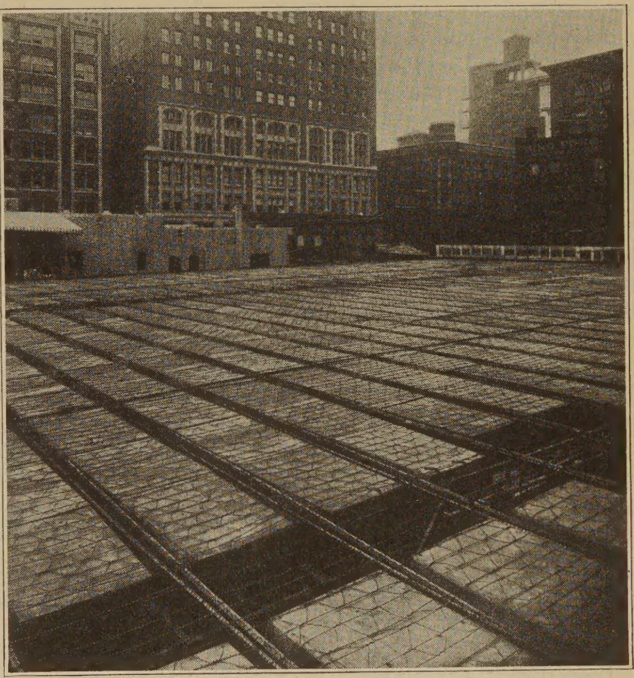
No restricted equipment is involved in the work or in this article, since a number of firms are in a position to furnish the specialties required, and while it is usual to use some form of "tin pans" in forming the floors, an equivalent result may be readily secured by using an all-wood system involving boxes and soffit forms such as are used by the Avery Brundage Co. in Chicago. In general, the various methods are so much the same, except for some awkward and highly expensive ideas that have been observed, that but two typical sets of details will be discussed here to illustrate the general methods most widely and successfully used.

The system illustrated here, with various modifications, was that used on such jobs as the American Furniture Mart, Chicago (Wells Bros.), the Hibbard-Spencer-Bartlett Building, Chicago (Henry Ericsson Co.), Wausau Hotel, Wausau, Wis. (W. W. Oeflein), Stevens Hotel, Chicago (Geo. A. Fuller Co.), and on many other office buildings, hotels, schools, hospitals, warehouses, and other structures throughout the country.



Showing use of "tinpan" type of floor form with special shores

It might be generally stated here that in this type of floor construction it is customary to suspend the soffit forms from the beams and girders in steel construction, running supports from these girder soffits to opposite soffits, and with these supports acting as staging, to carry the entire form assembly in this way from the steelwork, thus eliminating shoring. Often 4-by-4's or larger timbers are suspended from the steel in parallel rows, and entire panel assemblies carried directly on these suspended units. This latter is good construction if properly done and leads to economy. Suspension is effected by sheet metal ties, tie wires, threaded tie rods, or special clips passed over the steel, and these are cut flush with the concrete after forms are stripped, except that when wire ties are used and a metal lath ceiling is to be installed, it is customary on many jobs to use the protruding wires for securing the metal lath to the soffits after the forms are stripped. Unfortunately, this suspension of formwork is hardly possible with reinforced concrete construction, except possibly by means of an untried system recently devised. When speaking of shores, then, in this article, it is understood that it applies to reinforced concrete construction.



Ready to receive the concrete

Details of Type 1

Fig. 1 shows a longitudinal and transverse section through a very simple form assembly, used where early

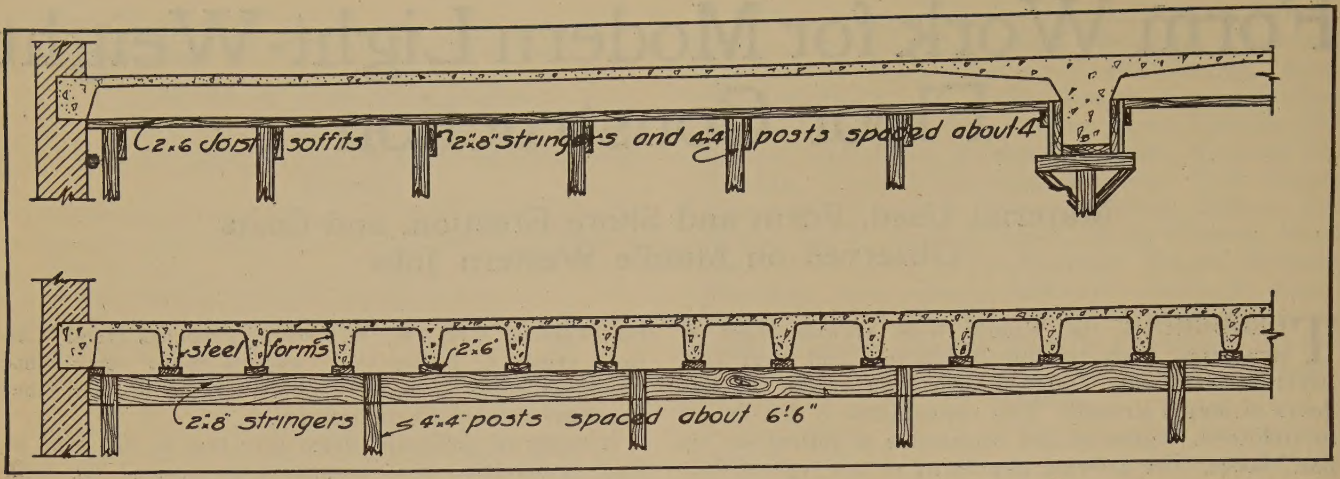

2x6 Joist soffits
2"x8" stringers and 4x4 posts spaced about 4'
steel forms
2x6
2x8 stringers
4x4 posts spaced about 6'6"

Figure 1

stripping is not required, and illustrating the junction of the floor with a masonry wall, as well as the method of forming and shoring at the girders. This construction is widely used, since it requires a minimum of lumber and is easily erected and stripped. The lumber used is standard 2-in. or 4-in. dimension material, but little nailing is required, and salvage is high.

In erecting these forms, a line of 4- by 4-in. shores, spaced about 6 ft. 6 in. apart, are erected, and the 2- by 8-in. stringer is nailed across the tops of the shores as shown, with the top of the stringer at such an elevation that it will be but sufficiently below the finished joist soffits to accommodate a 2 by 6 soffit form resting directly on the stringer. Parallel rows of this centering are erected in the bay spaced at about 4 ft. on centers, depending upon the size of the bay. The 2 by 6 joist soffits are then laid across the stringers on the desired centers, and the pans are then laid on the soffits, and steel then may be placed, conduits laid, and the concrete placed. As shown in Fig. 1, the beams are formed with 2 by 8 lumber in such a way that the pans may be stripped without interfering with the shoring under the beams.

Assuming a panel 20 ft. by 22 ft., the bill of material, exclusive of pans, and lumber used for bracing, scab blocks, wedges, sills, and waste, will be as follows:

	Board Feet
10 Joist soffits—2x6x22	220
6 Joists—2x8x20	160
18 Shores—4x4x12	288
Total	668

Since the panel is 440 sq. ft. in area, this may be readily computed to amount to 1.52 bd. ft. of form lumber per sq. ft. of floor—a very low figure.

If the panel would be used for an inside bay, with beams on both sides, the stringer and posts along the wall would not be needed, since the soffits would rest on the beam sides, and the form lumber requirement would be reduced to about 1.35 bd. ft. per sq. ft. of floor. Bracing will add 1.75 bd. ft. per sq. ft. of floor.

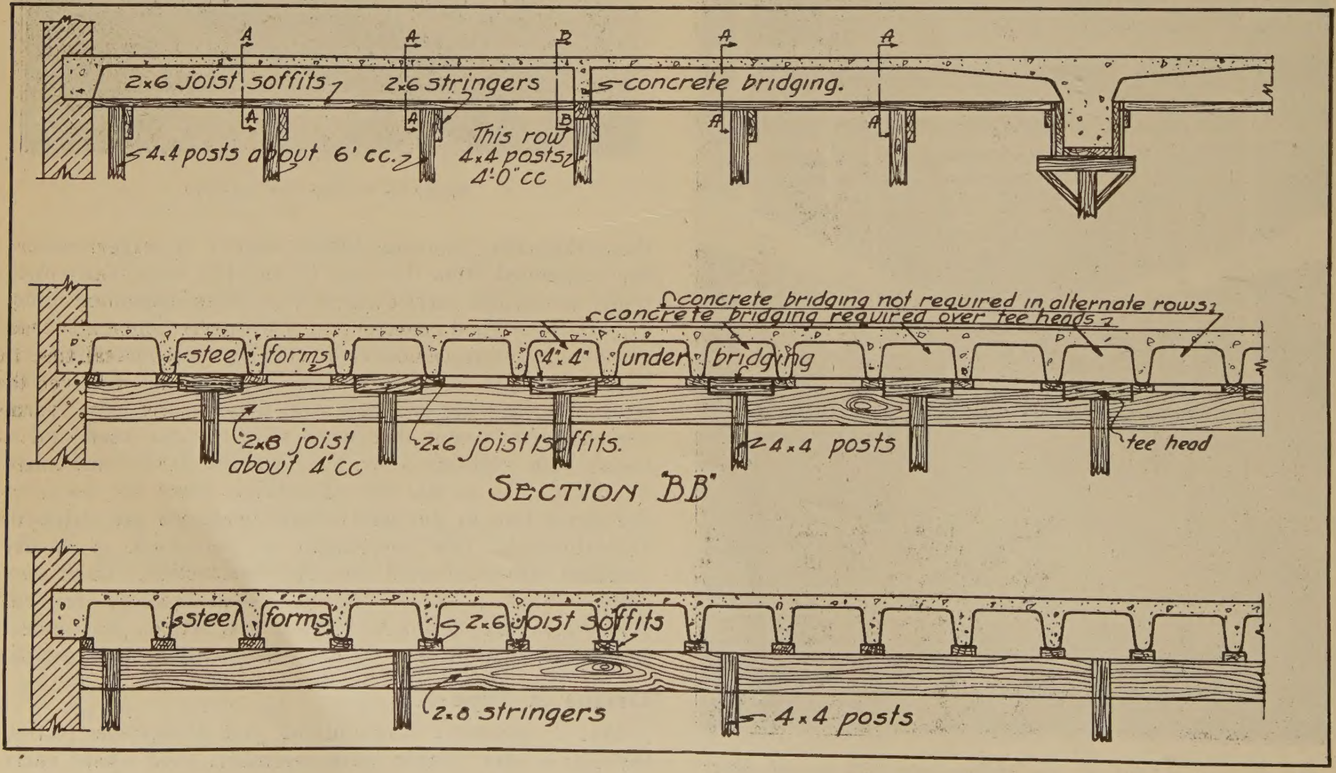


Figure 2

In figuring costs on this construction, the contractor will find that his salvage will run about 50 per cent. It will be found that pans will cost from 7 to 9 cents per sq. ft., erected, and that the centering will cost from 11 to 15 cents per sq. ft. in place, while materials and labor for column forms will run to about 20 cents per sq. ft., column clamps will add about 25 cents per use, beam erection will cost about 20 cents per sq. ft., and shores will cost about 25 cents per use. These costs represent current experience in the Chicago area, and will vary with location, due to the labor market and costs of material, and should be used with great caution.

Details of Type 2

It is of interest to compare the above simple method with another and equally useful method shown in Fig. 2. This latter method of forming is devised for use in tall buildings where pans must be stripped for reuse within three or four days after the concrete has been placed. Here the floor must be designed with concrete bridging joists as shown, under which shores are placed. This row of shores remains in place after other centering has been stripped. Otherwise soffits are carried in pairs on T-head shores and on stringers as shown.

The material needed for this type of centering amounting to 1.62 bd. ft. per sq. ft., is as follows:

	Board Feet
10 Joist soffits—2x6x22	220
6 Joists—2x8x20	160
20 Shores—4x4x12	320
5 Shore heads—4x4x⅛	11
Total	711

Naturally the material and labor cost involved is somewhat higher than in the first case described, but the fact that on a tall skeleton structure sufficient forms may be obtained for three floors, and by rapid stripping the work advanced with great speed, and the fact that this reuse of forms will save on material, makes this a very economical form system for the building of ten or more floors. Pan, beam, shore, and column costs will compare with those given for the first method, but the material and labor unit costs for centering will, of course, be higher.

These two methods are representative of common good practice and may be recommended. Some saving may be made, possibly, by pre-fabricating shores, stringers, soffits, beam sides, and column forms at the contractor's shop and delivering them to the job ready for erection. Some contractors will prefer patent shores. Others, as already mentioned, may discard pans altogether and build wooden form boxes as a substitute. Still, the method will be basically the same.

The two photographs show a typical application of the first system, modified by the use of a special shore, in the construction of the Eleventh Street Garage in Kansas City, Mo.

Physical Properties of Precast Stone

The tests to determine the physical properties of precast stone with the object of preparing federal specifications for this material have been continued by the Bureau of Standards. Forty-four samples were submitted by twenty manufacturers located throughout the United States. A few changes have been made in the method of testing since a previous description was published. The dry weight of specimens was determined by heating at 110 deg. C. until constant weight was obtained, which usually required about 72 hours. Compressive strength is determined on cylinders 2 in. in diameter and 2 in. high, a size selected because specimens of homogeneous material could be obtained from most samples of stone, including the type with facing. The compressive strengths ranged from 1760 to 10,300 lbs. per sq. in. Twenty-one per cent of the specimens had strengths of over 8000 lbs. per sq. in., 58 per cent over 6000 lbs. per sq. in., and 91 per cent over 4000 lbs. per sq. in. Modulus of rupture determinations were made on 1 by 1 by 8 in. prisms tested on a 6-in. span, and results varied from 180 to 1575 lbs. per sq. in. Twenty-two per cent of the specimens had a strength of more than 1100 lbs. per sq. in., 45 per cent more than 900 lbs. per sq. in., and 91 per cent more than 500 lbs. per sq. in. The rate of absorption was determined under the condition of total immersion in water on the broken halves of the modulus of rupture specimens. The amount of water absorbed, expressed in percentage of dry weight of specimens, was determined after ½, 2, 4, 6, 24 and 48 hours, and also after 5 hours' subsequent boiling. At ½ hour the absorption ranged from 0.8 to 13.1 per cent. Fifty per cent of the specimens absorbed less than 5 per cent. At 24 hours the range was from 2.4 to 14.0 per cent. Only 7 per cent of the specimens absorbed less than 5 per cent. At 48 hours the range was from 3.5 to 14.0 per cent, 3 per cent of the specimens absorbing less than 5 per cent. After 5 hours' boiling the range was from 7.7 to 19.2 per cent. Only 13 per cent of the specimens absorbed less than 8 per cent of water.

The ability to withstand weathering has been determined by cycles of alternate freezing and thawing. The specimens for this test are cylinders similar to those used in the compression test. The test specimens are placed in water for 48 hours previous to the first freezing cycle. The freezings are made while the specimens are standing in ¼ in. of water. Less than one-third of the specimens have reached the end point, or point of complete failure or disintegration, and for this reason no definite conclusions as to the value of the other tests as an indication of the ability to resist freezing can be stated at this time. The end point has been reached at a minimum of 65 cycles and a maximum of 380 cycles in those specimens where the tests have been carried to completion. A half dozen specimens have already withstood 475 cycles without any indications of failure.

A. C. I. Building Regulations Officially Adopted by State of Florida

On October 19th the Board of Supervising Architects of the Florida Hotel Commission, at a meeting in Jacksonville, amended Rule 354 of the Commission's building regulations in such a way as to adopt, by reference, the 1928 Tentative Building Regulations for Reinforced Concrete, recommended by the American Concrete Institute.

The A. C. I. regulations may accordingly be employed in the design of reinforced concrete hotels and apartment buildings, both of which are among the classes of occupancy coming within the jurisdiction of the Hotel Commission.

Pipe Manufacturers Meeting to Follow A. C. I. Gathering

The twenty-second annual convention of the American Concrete Pipe Association will follow close upon the heels of the American Concrete Institute, since it is to be held at Detroit, Mich., at the Book-Cadillac Hotel, on February 14th to 16th, inclusive.

Detroit was chosen because, aside from the fact that the larger organization is meeting there as well, the city has presented some real sewerage problems and has four large concrete pipe plants.

P. G. RILEY
President

P. G. RILEY
GENERAL CONTRACTOR

T. G. McGOVERN
General Supt.

~~701 Temple Street, Pittstown, N. Y.~~

Los Angeles

Dear Mac:

I dropped into John Murray's office a few days ago and when John saw me he yells, "Hey, P. G. come in here," and when I got in I says, "Well, what's new?" He answers, "Oh, nothing much only I just killed the bull." "Well," says I, "How did he get in here? I have heard him often when I have been with you out to the golf course." "Yes, you have, you old crook," says he, "come out with me this afternoon and it will be no bull you will hear. It's time you learned the game anyway."

"Is this bull you are talking about a new name for some old drink," says I. "If so, let me kill one."

"No, sit down, you old loafer, and I will tell you about it," says he. After we had lighted up our pipes he says, "P. G., old timer, I spent the greater part of this week listening to pump salesmen and a fine lot they are too. Good, live boys every one of them. Each one of course told me he had the best pump and went on to prove it to me. I should know a lot about pumps by now, but do I? I do not. I'm dizzy."

"Now, I don't buy anything on friendship nor at lunch, on the golf links nor at the last end of a full bottle. Not me, P. G."

"Well," says I, "isn't buying a matter of confidence in the seller?"

"Maybe so, P. G. my boy," he says, "but it is more sensible and safe to have that confidence backed by something more tangible than mere words. Each seller, P. G., is naturally sold on his own product and is also naturally prejudiced. Should the buyer then bet his money on some one's else judgment, no matter how good a friend he is, when it doesn't even pay sometimes to bet on his own?"

"I used to buy a pump with the idea that a pump was a pump, and let the fellow with the lowest price send it over quickly. Not me, any more."

"What was wrong with that?" I prodded. "Well, says he" "if you were to buy a suit of clothes that way, you would figure that $15.00 was cheap for a suit and you would look around for a $15.00 suit and get it."

"If I bought a pump or a concrete mixer or any other piece of equipment on that basis somebody would meet a low price but I know I would get a machine worth just as much money as I paid for it and no more. Price, I have learned, is the admittance ticket either to satisfaction or trouble."

"Well, what about this bull-killing stunt," I inquired, watching the clock as I just remembered I was to meet Mother down about three blocks.

"Listen, and I'll tell you," says he. "I find each salesman usually picks out some talking point or points which may or may not be just talking points. Some designers design talking points into the machine just for talking points. Every household has dozens of labor saving contraptions sold to them by back door specialists who paint a beautiful picture of labor saving. Usually these articles are used once or twice and discarded. Nope, I don't buy equipment like some women buy cars, for the embellishments and decorations. I want performance."

"Yes, old top," says I, "but how did you kill that bull, talk him to death?"

"Oh, shut up," says he, "I am creeping up on him now. I won't buy on price. I won't be influenced by selling talk. The machine itself will have to sell me and this is how I killed the bull, you old son of the old sod. The machine has got to do its own talking on my job before I buy it. I am not leaving it up to clever selling or even to clever buying."

"Will the seller play that way?" says I. "They'll have to," says he, "and that goes for my friends in the equipment business too, for I figure we will be friends longer if we do business in this way."

Maybe that's an idea, Mac. See if you can kill one or two bulls yourself. And say, Mac, machines should be picked out like we used to pick horses. Just because some one said a horse was a good horse and we could have it cheap on account it didn't match anything a fellow had, was no reason for our buying the horse unsight and unseen. Neither were we influenced by tail and mane ribbons or polished hoofs. We looked into his mouth, found out who his mother and father were, tried him out for wind and speed and endurance before we bought him. For. if we didn't, like as not we would find we had bought a crow-bait.

Sincerely yours,

PG

This is the eighth letter of a group whose publication began in the May issue of CONCRETE *written by P. G. Riley, retired contractor, to his superintendent, Tom McGovern, back home. "P. G." is taking his ease in California and the distant fields, where he was once so active himself, look mighty green now.*

Perhaps his greatest pleasure is in keeping in touch with his superintendent and, off and on, his secretary, Anna Ryan. His being away from the scene of activity has given P. G. some new viewpoints and he manages, in his letters, to convey to the young folks some of the ideas in the back of his head. One of the bits of advice he has already given "Mac" concerned the wisdom of investigating operating performance when buying equipment. At another time he told Mac of the "catch" in the seemingly attractive trade-in offer. There's a lesson, too, he said recently, in not letting old, inefficient equipment eat up the profits.

That there's a fallacy to purchasing the lowest priced equipment offered, "P. G." discovered to his own enlightenment when spurred into looking into the subject by a little incident, he told "Mac" in a later letter.

"P. G." addressed his next letter to Anna Ryan, his secretary, who, evidently alarmed at Mac's somewhat rash participation in bidding for jobs, wrote Riley about the matter.

Road Reconstruction in the Los Angeles Metropolitan Area

Placing "Second-Story" Concrete Pavement on a Road Widening and Rebuilding Project—Construction Methods Used—Job Arrangement and Plant—Aggregates Measured by Weight—Three Sizes of Aggregate Used—Weakened Plane Joints

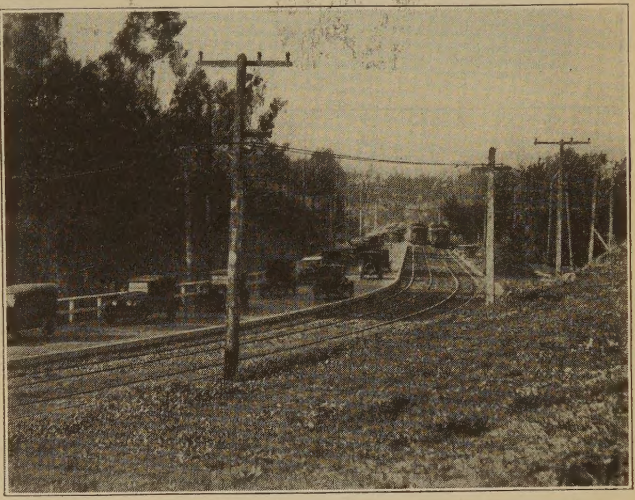
THE Los Angeles metropolitan area has successfully carried out, during the last few years, one of the largest road reconstruction programs in the country. Included in this program are such projects as the building of Pico Boulevard, Cahuenga Pass Highway, numerous road widening jobs, reconstruction of existing highways, relocation, realignment, and a general program of increasing the traffic handling ability of all routes leading into the metropolitan area.

In practically all cases this work has been of major proportions; some of the jobs attracting country-wide interest. Coupled with the reconstruction program has been the use of methods, devices and control of concrete which puts the area out in the fore of progressive concrete construction.

A typical example of this class of work is the reconstruction of the state highway between Redlands and Beaumont. This state highway is the main route to Imperial Valley and carries an unusually heavy pleasure car and truck traffic. The area around Palm Springs and Indio and the desert spots along the highway attract visitors from all over California. The reconstruction as completed will greatly improve conditions in Reservoir Canyon on the Roosevelt Road just outside Redlands.

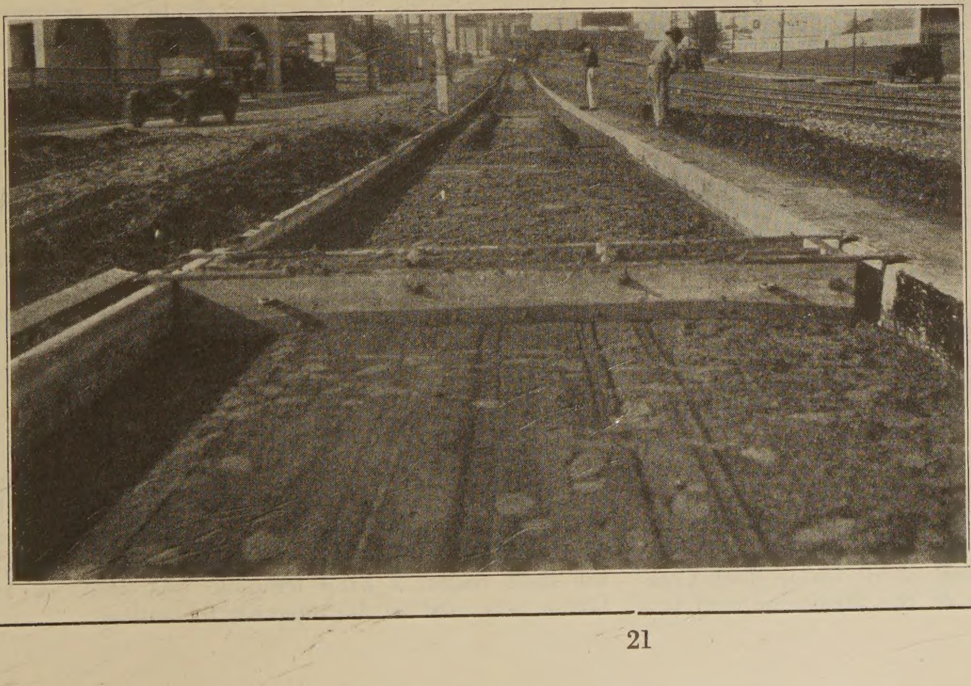
Reservoir Canyon Reconstruction

Before the present highway construction, the road in Reservoir Canyon, which is the local name for the section, was narrow, winding and full of curves. The state highway commission allotment provided for widening, easement of curves and lowered grades, in addition to new surfacing with substantial cement concrete.

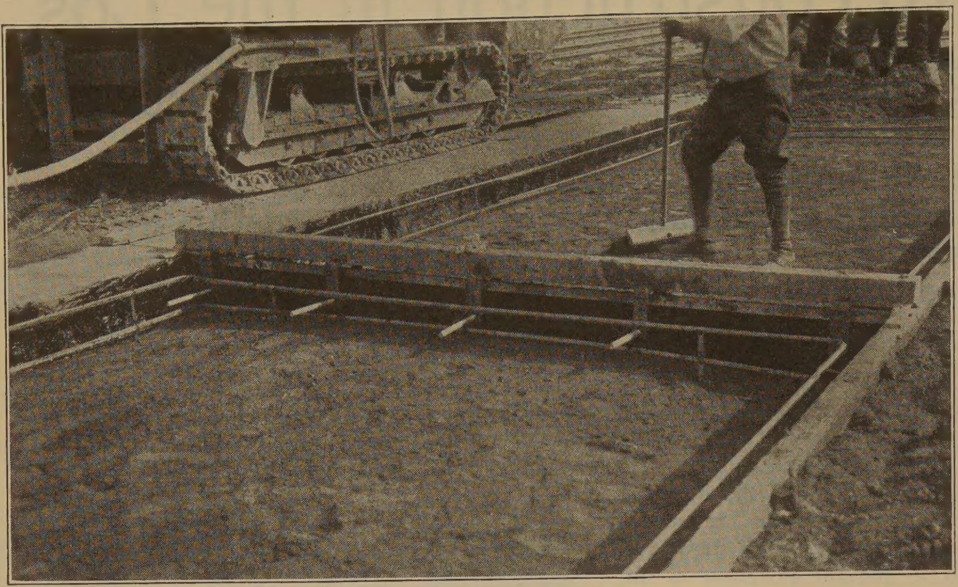


The new roadway carries a heavy traffic

One mile of the stretch included in the contract was "second-story" concrete over an existing concrete base. The balance of the work consisted of replacing the narrow, inadequate macadam. The rock was salvaged, how-



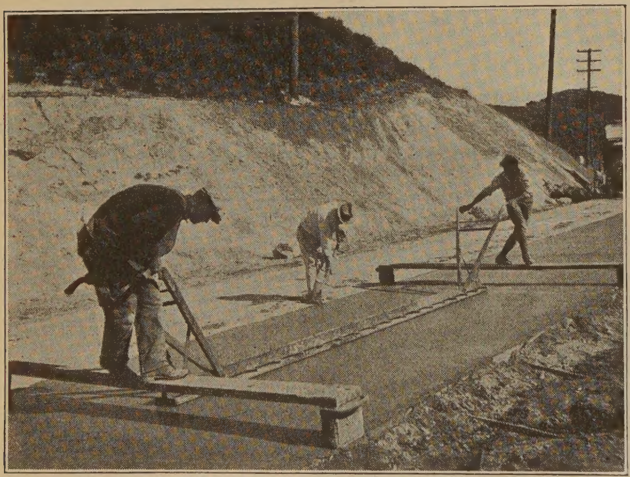
Showing the sub-grade template



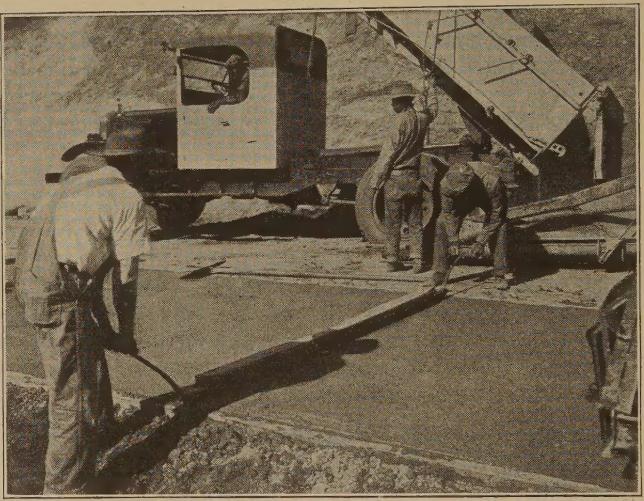
Marginal bars and dowel assembly at full expansion joint. Joint material is held in place by the device shown resting on forms

ever, and was used to construct 3-foot rock shoulders alongside the pavement slab.

Approximately 25,000 cu. yds. of dirt had to be moved, in the widening and filling operations. A. P. and H. gas shovel was used for this work. Four box culverts, 4 by 8, 6 by 10 and 6 by 8-ft. retaining walls, 1,500 ft. of 8-in. drains and approximately 2300 ft. of 12-in. to 24-in. corrugated metal pipe with other construction incidental to drainage made up the preparatory work.



The longitudinal float is operated from parallel bridges



This cutting tool is used to make weakened plane joints

Central Proportioning Plant

In organizing the construction procedure, a batch plant was set up at the Southern Pacific railway siding at Redlands and the entire job was batched from this plant. A 100-ton bin, divided for the three classes of aggregates—sand, ¾-in. rock and 2½-in. rock—was equipped with a weight measuring bucket of Madsen make and a Chaillon scale. The bin was set at ground level and a tunnel excavation was made for the truck runway. The dirt from the excavation provided a mound upon which a Thew clam crane was perched, this machine being used for unloading cars, stockpiling and loading the bins. The rock supply was from the Kincaid plant of the Union Rock Company. The Claremont plant of the same company furnished the sand. All aggregates were shipped by rail.

A fleet of trucks ranging from six to ten, according to the length of haul, supplied the mixer. Cement was hauled to the grade and dumped into the mixer skip at that point. The batch trucks carried four batches each trip; each batch weighing approximately 3248 pounds. The mixture design varied somewhat, of course, but a typical setting was 1300 pounds of ¾-in. rock, 850 pounds of 2½-in. rock and 1100 pounds of sand. These weights included the moisture in the material.

The haul to the mixer was a maximum of 7.8 miles and minimum of 3 miles, there being a 3 mile dead haul. A grade was encountered the entire distance, but was not excessive.

Plans for the cement concrete pavement slab called for a section of 6-in. pavement, thickened at the outer edge to 9 inches. Subgrade was made on the portion not "second story" within an inch or two of the finished grade to provide for a sand cushion. All changes in alignment, superelevations at curves etc., provided for sand filling. After the headers were in place, a Carr subgrader and 30 Best tractor facilitated the grading. Directly ahead of the final roller, a hand template was used. A 14-ton Galion was used on the subgrade for rolling.

The 20-ft. width of roadway was built in two sections each 10 ft. wide. Each 20-ft. panel of the half-width section was reinforced with marginal bars and 3-ft. bars on 18-in. centers were used over the edge of old narrow pavement in "second story" work. The marginal bar design with ½-in. bars provided a completed encircling of the 20-ft. panel top and bottom. All reinforcing was assembled for each panel and placed just ahead of the mixer operations. Approximately 273,000 pounds of reinforcing steel was included in the work.

After cutting tool for dummy joint is withdrawn, the steel bar is pounded into the slot. It is withdrawn after finishing

Weakened Plane Joints

The roadway slab is divided transversely with expansion joints of ½-in. material spaced 60 ft. apart. Weakened plane joints, consisting of a slot 2 in. deep divide the 60-ft. panel into three 20-ft. panels at the junctions of the marginal reinforcing. The method of placing the expansion joints is not unusual as an ordinary metal header was used. The weakened plane joints were made in the following manner: After primary finishing operations of striking off the concrete, a metal strip, ¼-in. thick and 2-in. wide by 10-ft. long was driven into a slot formed by a T-bar device. The metal in a vertical position was completely submerged. After final finishing, the metal strips were pulled to the surface and the joint edged.

Finishing over joint material

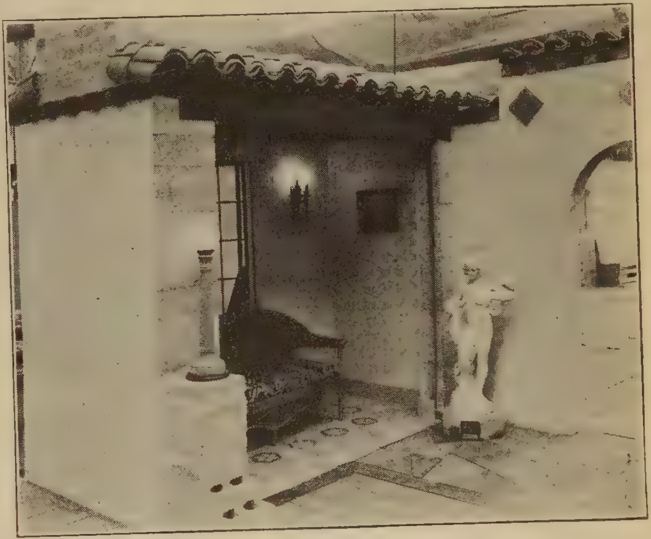
Good progress was made with the Rex 27-E mixer. Approximately 1000 ft. of 10 ft. width was laid daily. A Lakewood tamper followed the mixer and further finishing was accomplished by longitudinal floats. A strip of burlap was used after the second longitudinal float. Riding surface evenness is of primary importance to cement concrete pavement construction and this was checked continually with a 12-ft. straight-edge. A notched straightedge was used for the joints. Curing was done by earth cover and sprinkling. Concrete strengths recorded averaged about 3500 pounds per square inch at 10 days.

The contractor encountered no obstacles that delayed the work and good organization pushed the construction along rapidly. Construction supervision was furnished by Division VIII of the California Highway Commission, E. Q. Sullivan, division engineer, R. L. Young, assistant. R. C. Payne, resident engineer was in direct charge. Mattich Bros. of Elsinore were the contractors. Ten firms made bids for the work and Mattich Bros. contract involved a total of $153,410 as the lowest bid.

Concrete Used in Attractive Exhibit at Pacific Southwest Exposition

One of the most interesting exhibits to depict the use of concrete and concrete products was built for the Portland Cement Association, Los Angeles office, at the Pacific Southwest Exposition held recently at Long Beach, Calif.

Through the co-operation of local concrete products manufacturers and concrete construction men, the Portland Cement Association was enabled to show a wide range of the uses of cement in the construction of the booth. Reinforced concrete hollow wall construction, concrete tile, stucco, concrete roof tile, floor tile and art objects were shown.



Those who participated with the Portland Cement Association were: Booth designed by Claud Beelman, architect; stone-tile, Fillmore-Wiley Company, Los Angeles; concrete hollow wall, Coast Concrete Construction Co., Los Angeles; stucco, California Stucco Products Co., Los Angeles; roof tile, Spanish Tile Roofing Co., Los Angeles; floor tile, Colortex Tile Co., Los Angeles, and Expo Stucco and Art Marble Co., San Diego; chemical wall and floor stains, Lammens Process Co., Los Angeles, and Color Control Company, Los Angeles; ornamental concrete, Brooks Art Stone Corp., Pasadena, bench; Royalart Company, Los Angeles, jug; Marbelite Corp., Los Angeles, miniature lighting standards; Henry Decorative Stone Co., Los Angeles, statue.

Detroit Prepares for Concretors' Meeting

Local American Concrete Institute Members Form Convention Committee to Facilitate Warm Hospitality—Rough Outline of Program Announced—Cast Stone Session to Be Included

HOW best to apportion the time of concretors who attend the forthcoming American Concrete Institute sessions in Detroit is now receiving the attention of the local convention committee, composed of George H. Kenkell, general manager and chief engineer, Detroit Board of Water Supply, chairman; L. E. Williams, engineer, State Concrete Materials Company, vice-chairman; and L. G. Lenhardt, engineer-in-charge, Land Tunnels, Detroit Board of Water Supply, secretary.

Eight technical sessions will comprise the convention, all of which will be open not only to members of the Institute but to everyone having an active interest in concrete design, construction and manufacture. The customary get-together luncheon at noon on Tuesday, February 12th, will precede the sessions.

Papers presented at the first session, on the afternoon of the 12th, will be devoted to the general theme of "A Condition Survey of Concrete Structures," undertaking to show that concrete properly designed and placed stands for many years under severe exposure and that other concrete carelessly made shows definite evidence of less permanence. A variety of conditions on numerous types and kinds of construction will be considered in this symposium.

The evening session of the same day is to include several papers illustrative of the importance of concrete in large projects in Detroit and the vicinity. Among these will be one on the land tunnel work of the Detroit Board of Water Supply, by Mr. Lenhardt, and another entitled "The Economy of Quality in Concrete," by Messrs. Douglass and Nelles of the Detroit Edison Company.

On the second day there will be two concurrent sessions in the afternoon. One will be devoted to research papers covering a wide range of subjects and including a contribution by Prof. Raymond E. Davis of the University of California, on "Volume Changes in Concrete," reporting data and conclusions from a long series of tests.

Cast Stone Session

At the same time, manufacturers of concrete stone and ornamental work and others interested in these subjects will hold their meeting in another room to discuss specifications for stone and special problems involved in meeting architectural requirements.

Concurrent sessions will be repeated in the evening, when those interested in the manufacture of standard concrete building units, block, brick and tile will meet. Another group will meet at the same time for the consideration of the theme, "The Development of Reinforced Concrete Specifications in the Last Decade." Further consideration will be given at this time also to the Joint Standard Building Code, tentatively adopted by the Institute last winter.

Attention at both morning and afternoon sessions of Thursday, the third convention day, will be directed to a symposium of about ten papers from as many authorities on concrete, setting forth the special characteristics required in concrete to meet different uses and exposures. Examples of these are wear resistance in floors and roads, livability of concrete houses, impermeability and weather resistance of hydraulic structures, permanence in stucco, etc. It is anticipated that the contents of these papers, while brief, will bear much of real value when put into practice.

The annual dinner will draw the meetings to a conclusion. At this time two medals will be awarded—the Leonard C. Wason medal for the most meritorious paper presented at the 1928 convention in Philadelphia, and the Henry C. Turner medal for "notable achievement in the field of concrete."

Nominations

A canvass of ballots for members of the Nominating Committee has resulted in the election of the following: M. M. Upson, chairman, Arthur N. Talbot, Cloyd M. Chapman, Stanton Walker, and R. W. Crum. The report of the Nominating Committee will be submitted to the membership of the Institute early in December and 20 days allowed for additional nominations direct from the membership. The ballot to include all nominations will be sent to the membership 30 days before the convention and the result canvassed on the second convention day.

Workability of Portland Cement Pastes

Three methods of tests for workability of cement pastes —the extrusion cylinder, the ball plasticimeter, and the capillary tube—were discussed in a bulletin released by the Bureau of Standards of the Department of Commerce in the spring. A fourth method of testing for workability of cement pastes, using the MacMichael viscometer with its modified "paddle," has now been studied by the Bureau of Standards. This instrument was too small to permit the study of dry mortars. However, a summary of the results already obtained develops two items of interest. First, a comparison was made between the workability of the cements when tested as neat pastes, as shown by the MacMichael instrument, and also as shown by the three methods of test referred to above, which were also reported in the paper published in the Proceedings of the American Concrete Institute, "Cement as a Factor in the Workability of Concrete," Volume XXIV, 1928, pages 43-55. There was quite good agreement in this respect between the MacMichael instrument and the capillary tube reported in the earlier paper. Secondly, at least within the scope of the instrument used, the relative results of a number of cements tested as neat cement pastes, or in a mortar of a certain proportion, may not be the same as the relative results obtained when testing the same cements in a mortar of different proportions.

~ EDITORIAL ~

Durability

FROM many sources the question, "What is durable concrete?" is being asked. Engineers want to know so that they can design it into their structures. Architects want to know so that they may use concrete with assurance. Contractors want to know so that they may build it into the job. Owners want to know so that they may be assured that their structures will withstand the onslaughts of time and weather.

Offhand, it seems that strength is the best criterion of durability. Undoubtedly it is true that resistance to wear and stress is in some manner proportional to strength. But is this the only measurement we have for durability?

There still remain such important questions as chemical disintegration, permeability, shrinkage, expansion and contraction due to moisture variation, etc. Are they not of equal or even greater importance than strength as a measure of durability.

Constantly more emphasis is being placed upon these factors. Progressive engineers are designing their concrete with these factors in mind. They are not only aiming at strength, but are considering their aggregate combinations, their water content, etc., so as to secure the greatest density, impermeability, uniformity and workability, knowing that all these factors have as important a bearing on the durability of the concrete as has strength.

It is known, of course, that when the fundamental requirements of making quality concrete are complied with and when care is exercised in the field to obtain uniformity in mixing and placing, it is reasonable to expect durable concrete.

But why this is so has not yet been definitely determined. No absolute means of pre-determining durability has yet been evolved as has been done in pre-determining strength. If there are definite relationships between durability and density, workability, strength, etc., these should be determined and a method of measuring them established.

It is a favorable indication that attention is shifting from strength to durability as the essential quality to be aimed at. Methods will yet be developed that will enable the concretor to predict durability with the same assurance that he now predicts strength.

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From Slide Rule to Wheelbarrow

IN speaking at the Portland Cement Association meeting recently, O. H. Cheney of New York, stressed the fact that the entire concrete industry "from the man who operates the slide rule down to the man who operates the wheelbarrow" must do his utmost to secure quality concrete on every job. The welfare of the entire industry and of every man in it depends on this need.

Every defect in a concrete job is a stronger advertisement against concrete than the best written advertisement is for it. The responsibility for future development of the industry, therefore, comes right back to every man actively engaged in concrete work of any kind.

There is danger of self-satisfaction in an industry that has made progress as rapidly as the concrete industry has. We are apt to feel that continued progress is inevitable—that the industry will continue to expand even if we become less exacting in our requirements.

The past steady growth in the uses of concrete is due to the unceasing efforts to improve the quality of the concrete and the aggressive merchandising of the industry as a whole and of its individual members.

Today, in the face of new needs and more severe criticism, the need is for still greater attention to quality control. Modern methods of concrete construction have supplanted the old, haphazard methods on many jobs. Each year more concretors are adopting the newer methods. Yet, even with this progress, most concrete jobs are still being built without the observance of some of the fundamental requirements for making and placing concrete.

It is not more difficult or more costly to be ***sure*** of the quality of the concrete placed. Information that will show how to make quality concrete is easily available from a number of sources. Improvement must continue until every cubic yard of concrete placed is made according to the simple, known requirements that will definitely assure a quality product.

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Highway Bridge Design

NO longer is the criticism true that bridges mar the beauty of a landscape. This criticism may have been applied justly to some of the older bridges constructed in America, but it is noteworthy that present bridge design, particularly as applied to state highway construction, is producing structures of unusual beauty.

Engineers trained to appreciate form as well as utility are designing and building bridges today that are of outstanding beauty. They are combining beauty of outline and surface texture with economy. Sympathetic public support of such programs permits the selection of bridge sites with an eye to appearances, and the use of sufficient time and funds to build bridges that will grace the landscape as well as provide structures that meet every utilitarian requirement.

Contractor Arranges Efficient Plant in Cramped Quarters

Construction of a Reinforced Concrete Building Inside a Court Formed by Old Buildings Gives Rise to Interesting Plant Arrangement—Original Layout To Be Changed as Building Progresses and New Space is Available

WHEN the Stewart-Warner Speedometer Co., of Chicago, was faced with an urgent need for additional quarters, it was found that land immediately adjacent to the existing buildings of the plant was not available. The only solution to the problem, therefore, was the construction of an additional building inside the court formed by the buildings already being used.

The court, about 250 ft. by 125 ft. in size, is enclosed on all four sides by buildings ranging in height from four to six stories, and the only entrance to the court is through a single narrow driveway or through the present buildings. With these limitations, the contractors, Jens Jensen & Son, were forced to "dope out" a layout and a plan of operation that would enable them to finish the structure in time for spring occupancy.

The new building, which will fill the court in one dimension, will be 10 stories high surmounted by a tower which will extend four stories higher. The design is in harmony with the present buildings and is so arranged that the new building will be a central tower for the entire group.

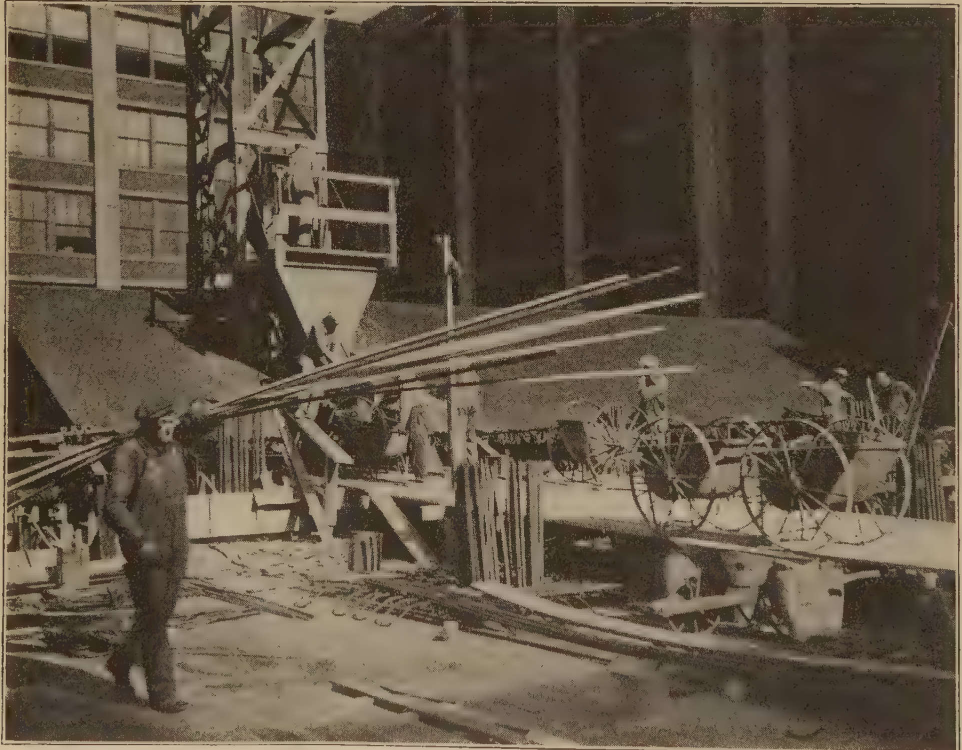
Plant Layout

An accompanying sketch shows the plant layout adopted for use during the construction of the first four stories of the new building. Aggregates are received in trucks which enter the court through the driveway on Lincoln Street. Separate piles of crushed granite screenings, sand and gravel are placed as shown. Cement is received in paper bags on trucks and is stocked in a covered shed near the mixer.

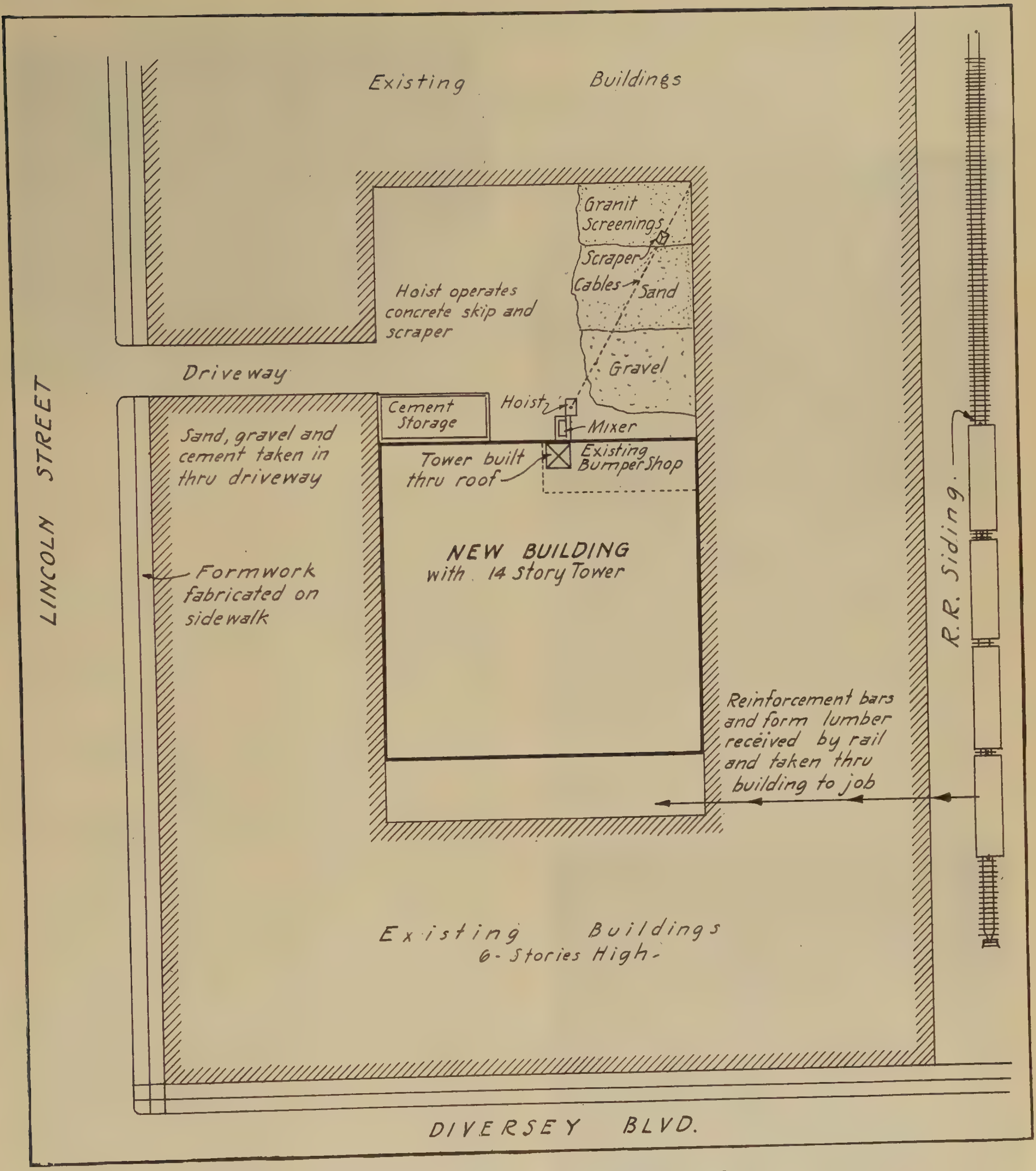
The concreting plant consists of a Cropp mixer of special design, a frame tower equipped with an Insley bucket and distributing hopper, and a Thomas electric, 2-drum hoist. Aggregates are proportioned in wheelbarrows at the stockpiles and dumped directly into the mixer from an inclined runway. The concrete is distributed from the tower hopper in buggies operating on temporary runways.

So cramped were the quarters available that the mixer had to be placed in a section of the one-story building that served as the bumper shop and the tower had to be erected through the roof of this building, as shown in one of the illustrations.

Reinforcing bars and form lumber are received on the company's railroad siding which parallels the east wall of the eastern building. The steel and the form lumber will then be carried through the building forming the eastern side of the court to the point where they will be used. A material hoist has been installed in the court between the south wall of the new building and the north



Showing the method of conveying the concrete to the forms. Note the tower passing through the roof of the one-story building


Existing Buildings
Granit Screenings
Scraper Cables
Sand
Hoist operates concrete skip and scraper
Gravel
Driveway
Cement Storage
Hoist
Mixer
Sand, gravel and cement taken in thru driveway
Tower built thru roof
Existing Bumper Shop
NEW BUILDING with 14 Story Tower
Formwork fabricated on sidewalk
LINCOLN STREET
R.R. Siding
Reinforcement bars and form lumber received by rail and taken thru building to job
Existing Buildings 6-Stories High-
DIVERSEY BLVD.

wall of the present building that forms the south boundary of the court.

While the first floors were being concreted the forms were fabricated on the sidewalk outside of the court.

An ingenious arrangement permitted the contractor to use the electric hoist for stockpiling the aggregates as well as for lifting the concrete in the tower. By simply changing the pulleys, power could be applied to a cable which pulled a scraper over the aggregate pile. With this equipment, screenings, sand and gravel were scraped from the floor where they were dumped back onto their respective stock piles. Because of the limited space available, the aggregates had to be piled high and well back.

Special Mixer Used

The mixer being used was designed by the contractor and built by the Cropp Manufacturing Co. of Chicago. Mr. Jensen had used one of similar design on a previous job and found it to meet his needs.

It is of the continuous type, consisting of two cylindrical compartments equipped with mixing blades. Proportioned aggregates and cement are dumped into the first compartment as the mixer revolves. The first compartment will hold about 14 cu. ft. of aggregate. When this charge has been mixed, it goes into the second compartment where it is retained until the hoist bucket is ready to receive the charge. In the meantime the second batch of aggregate is dumped into the first compartment and mixing goes on practically continuously. The concrete is kept in the drum for at least a minute and a half.

Mr. Jensen claims several advantages for his design. The mixer is in effect a steel cylinder that requires comparatively little room and the batch does not need to be raised to feed the mixer, as it is dumped directly from the wheelbarrow into the drum.

Cramped quarters forced the contractor to fabricate his forms on the sidewalk outside the court

Proportions

The bulk of the concrete to be placed will be mixed in the proportions 1:2:3, except in some of the lower floor columns, where a 1:1:2 mix will be used. All floors will be finished with a 1:2 mortar topping, using granite screenings.

After the first four floors have been concreted, the concrete on the first floor, which is approximately level with the floor of the court, will be hardened enough to permit the operation of trucks over it. When this stage has been reached, the entire mixing plant and aggregate storage will be moved to the basement of the new building. Here the mixer and the materials will be housed in—a distinct advantage during the cold weather.

Aggregates were taken from the stockpile to the mixer in wheelbarrows. In the right foreground is the cement storage

There is a large opening in the first floor which is provided for the installation of a large drop hammer. Through it the aggregates will be dumped into the basement. The mixer will also be located here and the tower will be erected in the elevator shaft. The balance of the 10 main floors and the 4 tower floors will be built from this new set-up.

An ingenious arrangement enabled the contractor to use the concrete hoist for operating a scraper which piled back the aggregates

Jens Jensen & Son, who are the contractors on the job, have built all of the older buildings now being used by the Stewart-Warner Speedometer Co. As is the case with the building now under construction, all of the other buildings were also erected during the winter. The contract was awarded on a cost plus basis. L. G. Hallberg & Co., also of Chicago, designed the building.

600-Ft. Arches Under Construction at Brest, France

Rapid progress is being made in the construction of the huge reinforced concrete arches of the bridge connecting Brest and Plougastel, in France, across the tidal estuary of the River Elorn.

This structure will have three main arches, each having a clear span of more than 600 ft. When completed they will be the longest reinforced concrete bridge arches in existence.

The forms for the arches are themselves of an arch design, built on falsework on the bank of the river several hundred yards upstream from the bridge site. The ends of the arched forms are supported on concrete barges floating in small slips excavated for the purpose. When an arch form is completed it is floated downstream on the barges, maneuvered into position, then jacked up to the proper level.

The long reinforced concrete arch spans in vogue among French bridge engineers are made possible because of the utilization of temporary hinges, explained in considerable detail in an article in CONCRETE, issue of October, 1926, pages 39 to 42. These hinges are left open long after the bridge is opened to traffic, and are not finally eliminated until the structure as a whole has taken its deformations and adjustments which, except for the presence of the hinges, would set up flexural stresses often exceeding the stresses due to the combined dead and live loads. By eliminating the flexural stresses mentioned a much greater part of the available working stress remains to resist dead-load and live-load stresses, and for a given span the cross-section of the arch is considerably lighter than would otherwise be possible.

Advanced Curing Room Design

Cincrete Corporation, Milwaukee, Wisconsin, Builds Additional Curing Rooms—Doubles Capacity of Plant—New Design Adopted—Mechanical Regulation of Temperature and Humidity

A complete description of this unique concrete products plant, in which the block machines move from curing room to curing room, was published in the October, 1925, issue of "Concrete." Since that time several changes and additions have been made in the plant that will be of interest to concrete products manufacturers. They are described in the following article.

IMPROVEMENTS and additions, consisting of the construction of six new curing rooms with their incidental equipment and the installation of an additional 21 cu. ft. Ideal mixer, brings the capacity of the present plant of the Cincrete Corporation of Milwaukee, Wisconsin, up to a total of 3,000,000 base units (8- by 8- by 16-inch block). This is nearly double the previous capacity, when ten curing rooms were in use.

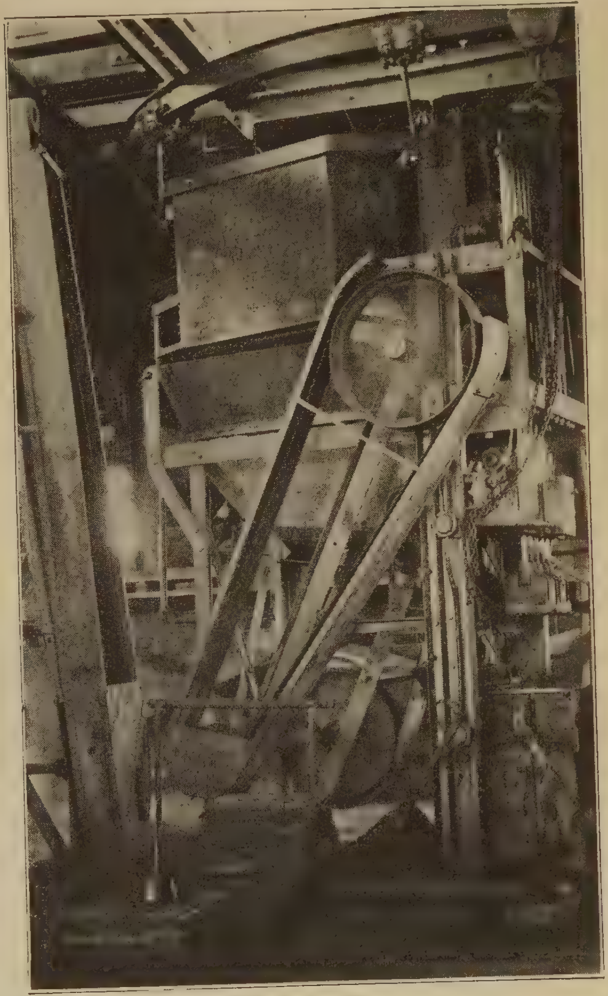
The new curing rooms, while similar in some respects to the old ones, are an improvement on them, embodying as they do, the most recent ideas in curing room design. The operation of the plant in this new section will also vary from that in the older section.

Though the older section of the plant, exclusive of the new curing room addition, has been described in detail in the July, 1925, issue, a review of the principal features of the plant will help the reader to understand the improvements which are to be described.

The plant is located on a 5-acre tract near the geographical center of the city in an industrial district served by water, rail and highway transportation. With its 956 ft. of dock on the Menominee Canal, adequate facilities for water transportation are provided.

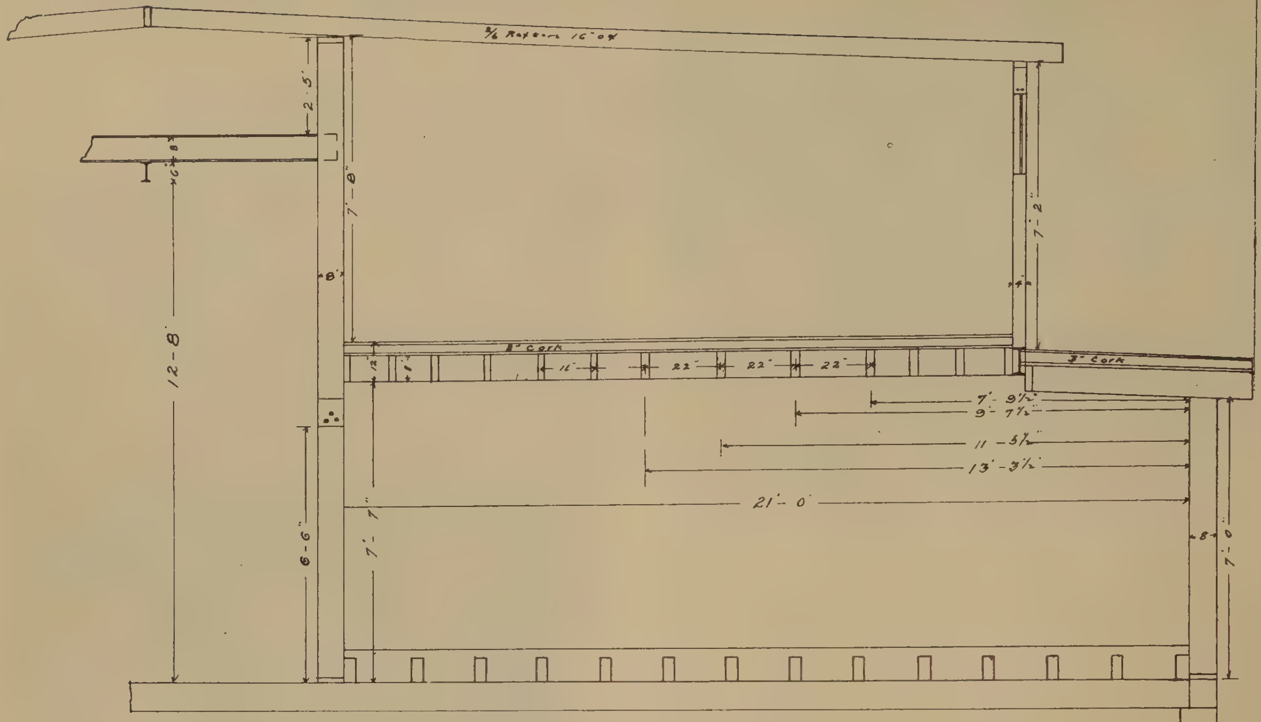
The new wing containing the curing rooms described

The property was formerly a coal yard. When acquired by the Cincrete Products Corporation, it was already equipped with two coal handling bridges. One of these, rebuilt and equipped for electrical operation, is used to unload the cinders which are received at the dock in barges. From storage the cinders are crushed and screened before they are placed in the crushed cinder storage bins which feed the mixers.



Illustrating the method of suspending the block machines from the overhead tramrail. The machines are moved into the curing room

The outstanding feature of the plant is its flexibility. Here the *machines* move from curing room to curing room. They are suspended from a substantial overhead tramrail system which extends from the corridors into every curing room. Each machine is a self-contained unit, complete with a hopper for feeding the molds. The machines weigh about 3,000 lbs. and are suspended from the same overhead trolley on which the mixed concrete is conveyed to the machine.



SECTION C-C THROUGH KILN NO. 4

scale ½"-1'

In the older section of the plant, the block machine is pushed into the curing room, thus making it unnecessary for the offbearers to carry the freshly molded block more than a few steps. As the curing room is filled, the machine is moved back.

In the section covered by the six new curing rooms, a slightly different procedure is adopted. The new curing rooms are arranged three on each side of a center corridor. The block or tile machine is brought into the corridor, suspended from the overhead tramrail previously mentioned, brought to the door of the curing room to be filled and operated from this point, instead of being

The new curing rooms. The doors are made of two layers of ⅝-in. boards separated by a 2-in. layer of cork pushed into the room as is done in the old section. Yale and Towne hoists are used to raise the machine from the floor.

The concrete is brought to the machines in the same manner as before, i. e., in portable, bottom-dumping buckets which operate on the overhead tramrail. Six of these buckets are in use. They are filled at two openings in the ceiling which is also the floor of the mixing level.

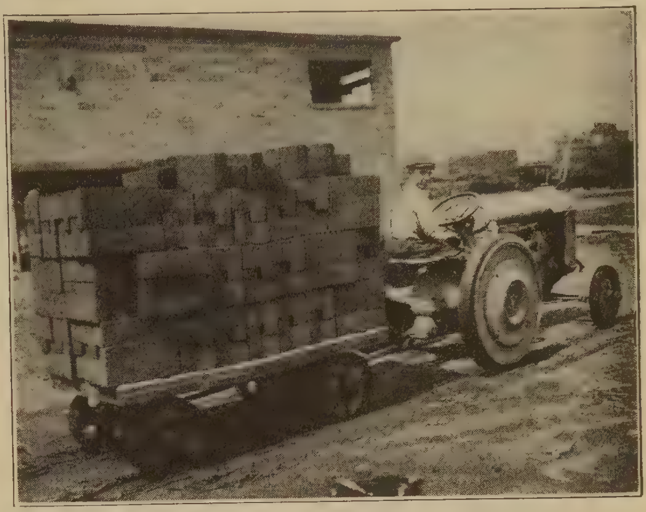
As it is now equipped, the plant operates two Anchor automatic strippers, and one automatic brick machine. There are two 14-ft. oversize Blystone mixers and one 21-ft. Ideal mixer. With adequate mixing capacity and the arrangement for transporting the block machines from place to place, the plant is unusually flexible and permits the use of curing space and equipment so as to secure the greatest possible efficiency.

As previously mentioned, there are six new curing rooms arranged three on each side of a corridor 8 ft. 8 in. wide. Each curing room is 11 ft. 8 in. wide and 21 ft. long. The curing room itself is 7 ft. 7 in. high, as shown in the accompanying sketch. Above the curing rooms are the fan rooms which will be described later.

The block are piled in the curing rooms in such a manner that the humidified air will reach every surface

Particular care was taken to have the curing rooms well insulated. Two inches of cork insulation is provided between the floors separating the curing rooms from the fan rooms above. Where the walls are exposed to the out-of-doors, a 3-in. layer of cork insulation was provided. The curing room doors are made of two layers of ⅝-in. tongue and groove boards, one layer on each side of a 2-in. layer of insulating cork. They are hung with counterweights and are opened by sliding the doors upward in the grooves.

A complete Sturtevant humidifying system is installed in the fan rooms above the curing rooms. By means of this arrangement warmed, humidified air is blown directly into the curing rooms in such a manner that the air penetrates to every section of the room, reaching every surface of every block.



Illustrating the method used to convey the block from the curing rooms to the outside stockpiles

The operation of the equipment is as follows: Air is drawn in through the grating shown in one of the illustrations, passed through heaters, humidified and forced by fans into ducts built into the curing room partition walls to a conduit at floor level. Slots are placed in this conduit which runs the entire length of the curing room at each side and spaced so that there is an air opening between each row of block. By this arrangement the humidified air is induced to flow between the individual blocks in each row.

The method of piling the block is also designed so as to secure the greatest benefit in curing. Blocks are piled 5 or 6 tiers high on 2-in. wooden planks extending across the curing room. Wooden blocks hold up these planks, spacing them vertically in such a manner that space is left for the circulation of the humidified air.

With this equipment the air in the curing rooms will be maintained at very nearly the saturation point. The temperature will be held at from 120 to 140 deg. F., depending on the outside weather. Ordinarily humidified air will be kept in the curing rooms for a period of 36 hours. Before the block are removed from the curing rooms, they will be "case hardened" or dried with a current of warm, dry air which will be forced through the same ducts that bring the humidified air. This air will be supplied by the same equipment operating as before, except that the humidifier will be cut out of the circuit. The dry air stream will continue for about 4 hours, which is considered long enough to remove the surplus moisture.

The cured block are loaded on 4-wheel reversible trailers which are pulled by a Fordson tractor (as shown in an illustration) from the kilns to the point in the yard where they are to be stored.

The Cincrete Corporation has developed very successful sales, advertising and service policies which in themselves will be discussed in another article. The company has adopted constructive and aggressive sales methods aimed at the merchandising of the 3,000,000 units it is equipped to manufacture annually.

Practical Kinks from the Job

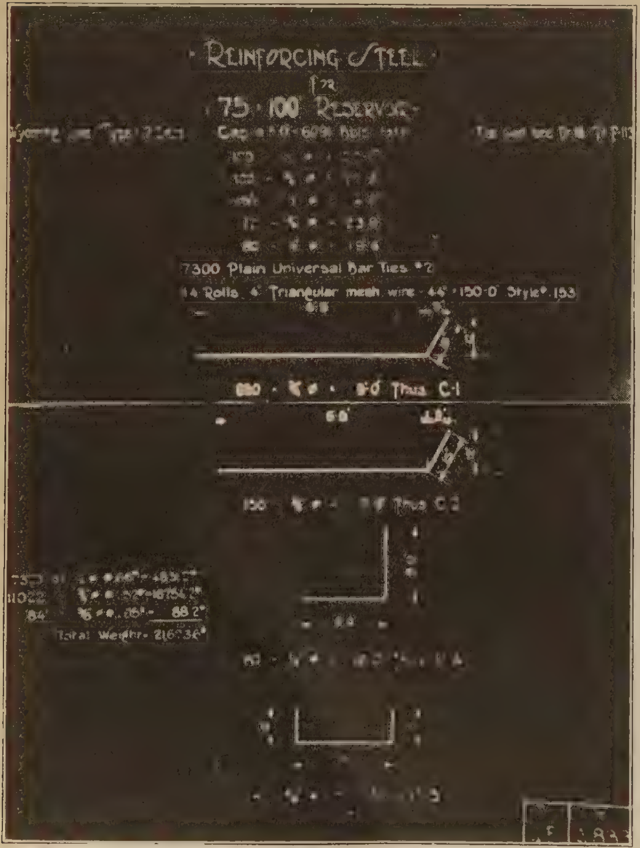
Rush Reinforcing Order Via Telephotograph

Having to place a rush order for reinforcing steel is not an unusual happening. Giving the order by telephotograph and having it filled and delivered in 13 hours, as was done recently, may, in time, become an ordinary occurrence.

The Sinclair Pipe Line Company of Tulsa, Oklahoma, was in urgent need of reinforcing material for building a large reservoir at LaRose, Ill. The order called for 1,890 reinforcing bars with 1,100 bends, 7,300 bar ties and 14 rolls of wire mesh, and was to receive personal and quickest possible action.

As the order was in the form of a blueprint with sketches of the bends, etc., it could not be transmitted by telephone. The factory representatives dispatched the order and sketch on the fast mail train to the St. Louis plant, where it was received in the morning. As the order could be filled more quickly from Chicago, it was immediately telephotographed, as shown, to the Chicago plant. Absolute accuracy was assured by this wired photographic system.

The order was written up in the usual way and copies were in the shop at once. The bonus time chart showed 3.1 hours shearing time and 3.5 hours bending time, but crews doubled up and in one hour and twenty-five minutes the material was ready. In the meantime the traffic department had lined up a car and in thirty minutes more the reinforcing was moving out of the plant.



REINFORCING STEEL
for
75 · 100 RESERVOIR

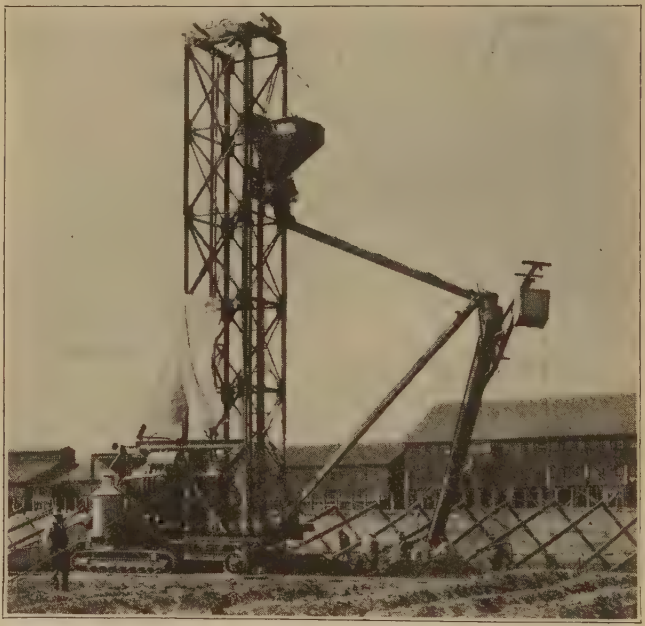
7300 Plain Universal Bar Ties #2
14 Rolls 4" Triangular mesh wire 46" · 150-0" Style # 153

Total Weight - 216[illegible]36#

The car number and routing were then wired to the Joseph T. Ryerson & Son St. Louis plant for advising the customer. The carload was switched from the Pennsylvania to the Santa Fe Railroad, and left Chicago that night. The car reached LaRose, Ill., at 4:20 in the morning, delivering the steel ready for use in the reservoir the next day.

Placing Plant on Pier Wall Job Is Unique

A contract for 4400 ft. of pier wall and two docks each 1200 ft. long and 100 and 220 ft. wide recently completed by the Monarch Engineering Company, Buffalo, New York, for a time gave promise of presenting a real problem in pouring the concrete, due to the area over which the work was spread. The contract called for completion within 2 years' time and this schedule was bettered by a full year with the use of a unique concrete plant.



The unit consisted of a standard 27-E Smith paver with boom and bucket removed and a 40-ft. tower, elevating bucket, receiving hopper and chuting supported directly on the paver. This equipment combined all the usual advantages of portability. The concrete was poured in three months.

Similar equipment has proven useful on large sewer work and also on the recent addition to the Galveston sea wall.

Tractor Handles Concrete Forms and Steel Rods

One of the many uses to which a tractor was put at the plant of the Caterpillar Company at Peoria, Illinois, was the pulling down of concrete forms and steel rods from a concrete seawall being built around the plant.

Reinforced Concrete Design Simplified

Chart H—Area of Additional Steel Beams Reinforced for Compression

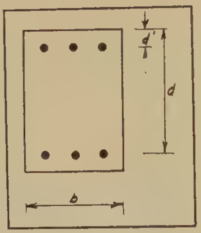
By PROF. JAS. R. GRIFFITH
Armour Institute of Technology; Assoc. M., A. S. C. E.

Joint Committee Specifications

$f'_c = 2{,}000$ lbs. per sq. in.
$f_c = 800$ lbs. per sq. in.
$f_s = 18{,}000$ lbs. per sq. in.
$n = 15$

$$A'_s = \frac{M_2}{f'_s\,(d - d')}\text{, Compression Steel.}$$

$$A_{s2} = \frac{M_2}{f_s\,(d - d')}\text{, Additional Tensile Steel.}$$



THE general theory for beams reinforced for compression was developed in the November issue. The unit stress in the compression steel can be determined from Chart G. Chart H has been designed to solve Equations 2-G and 3-G, giving the area of compression steel and additional tensile steel.

After the bending moment has been found for the given live-load and the assumed beam section, the necessary steps are:

(1) Determine the area of steel and resisting moment, for the section assumed, with balanced reinforcing.
(2) Fix location of compression steel and determine unit stress in it for that location.
(3) Determine area of compression steel and additional tensile steel for the surplus bending moment.

Chart Application

In the problem to be considered, each of the preceding charts is made use of in order to clear up several points in question.

Required to design a reinforced concrete beam with a simple span of 18 ft., to sustain a live-load of 2500 lbs. per lin. ft. The head room limits the overall depth of the beam to 24 in. Allowable stresses to be $f_c = 800$ lbs. per sq. in. and $f_s = 18{,}000$ lbs. per sq. in.

Assume overall dimensions of beam to be 16 in. by 24 in.

Protection below tensile steel to be 2 in., effective depth $(d) = 22$ in.

Protection above compression steel to be 2 in., $d' = 2$ in.

From Chart B:

16 in. by 24 in. beam, (Given)
Dead-load = 400 lbs. per ft.
Live-load = 2500 lbs. per ft.

Total Load = 2900 lbs. per ft.

Bending moment, 18-ft. span:
1500 lbs./ft. = 740,000 in. lbs.
1400 lbs./ft. = 690,000 in. lbs.

Totals 2900 lbs./ft. = 1,430,000 in. lbs. = M

End shear, span 18 ft.:
1500 lbs. per ft. = 27,000/2 = 13,500 lbs.
1400 lbs. per ft. = 25,000/2 = 12,500 lbs.

2900 lbs. per ft. Total 26,000 lbs.

Note that in obtaining the moment and end shear the load scale on Chart B did not go high enough to permit using 2900 lbs. per ft. as a single load. The total load was divided into two smaller ones, both coming within the limits of the load scale.

From Chart A:

$$\text{Given}\begin{cases} b = 16\text{ in.}\\ d = 22\text{ in.}\end{cases}$$

$$\left.\begin{array}{l} M_1 = 1{,}060{,}000\text{ in. lbs.}\\ A_{s1} = 3.1\text{ sq. in.}\end{array}\right\}\text{Balanced Reinforcing}$$

$M_2 = M - M_1 = 1{,}430{,}000 - 1{,}060{,}000 = 370{,}000$ in. lbs.

From Chart G:

$$\text{Given}\begin{cases} d = 22\text{ in.}\\ d' = 2\text{ in.}\end{cases}$$

$f'_s = 9{,}250$ lbs. per sq. in. (Compression Steel)

From Chart H:

$$\text{Given}\begin{cases} f_s = 18{,}000\text{ lbs. per sq. in. (Tensile Steel)}\\ f'_s = 9{,}250\text{ lbs. per sq. in. (Compres. Steel)}\\ \left.\begin{array}{l} d - d' = 20\text{ in.}\\ M_2 = 370{,}000\text{ in. lbs.}\end{array}\right\}\text{Use for Isopleth (1)}\end{cases}$$

$A'_s = 1.98$ sq. in. Isopleth (2)
$A_{s2} = 1.02$ sq. in. Isopleth (3)

Note: Draw isopleths connecting scales (*A-A*) and (*B-B*).

A_{s1} (From Chart A) = 3.1 sq. in.
A_{s2} (From Chart H) = 1.02 sq. in.

(A_s) Total area of tensile steel = 4.12 sq. in.
(A'_s) Total area of compression steel = 1.98 sq. in.

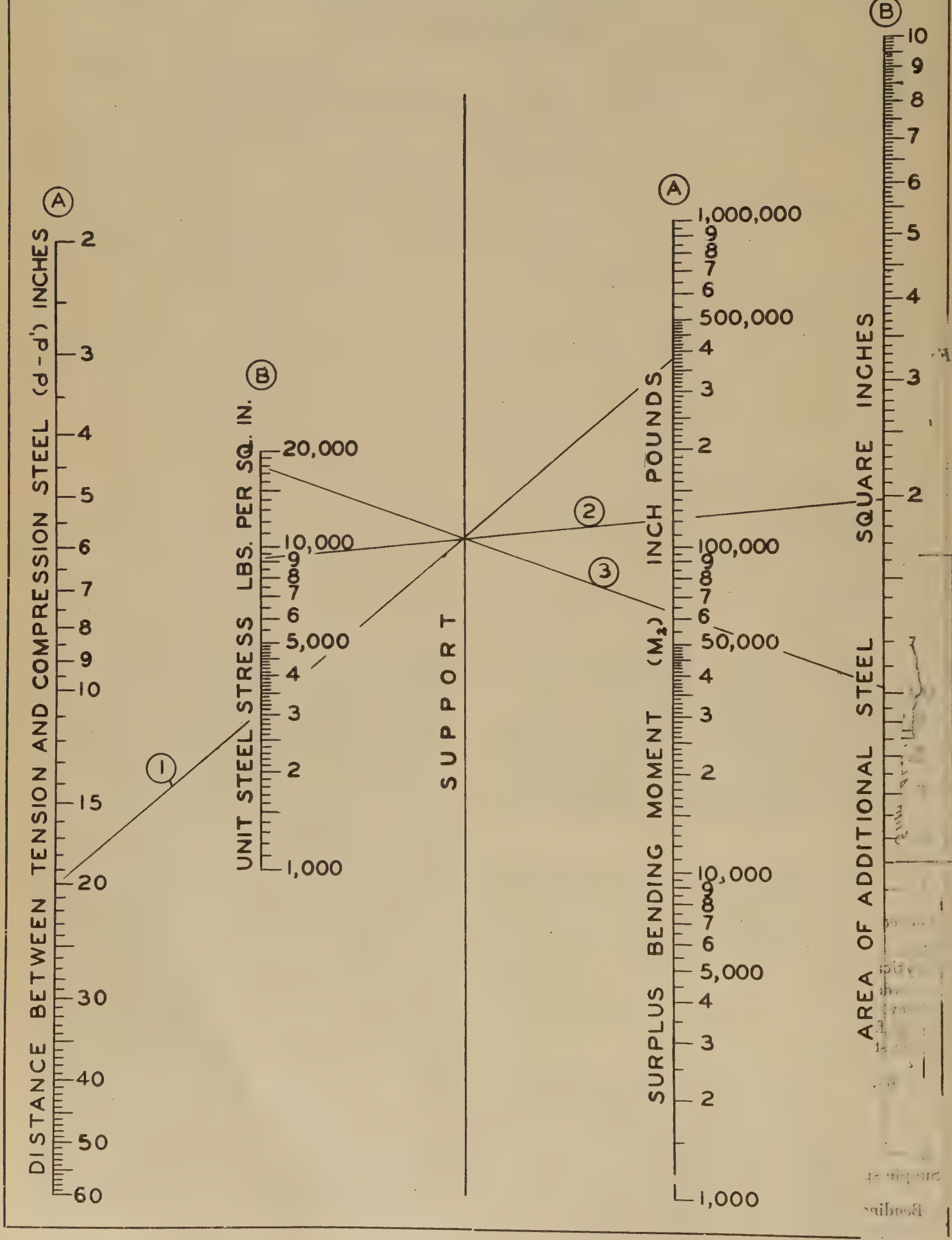
From Chart C:

$$\text{Given}\begin{cases} A_s = 4.12\text{ sq. in.}\\ A'_s = 1.98\text{ sq. in.}\end{cases}$$

For tensile steel use five 1-in. square bars.

CHART H

Area of Additional Steel
Beams Reinforced for Compression



For compression steel use four 7/8-in. round bars.

From Chart D-2:

Given
- Five 1-in. square bars
- Four 7/8-in. round bars } Add perim. on Chart
- $d = 22$ in.
- Total shear $(V) = 26{,}000$ lbs.
- Unit bond $(u) = 50$ lbs. per sq. in.

Use plain bars.

From Chart D-1:

Given
- $b = 16$ in.
- $d = 22$ in.
- Total shear $(V) = 26{,}000$ lbs.
- Unit shear $(v) = 83$ lbs. per sq. in.

Stirrups necessary.

From Chart E:

Given
- Unit shear $(v) = 83$ lbs. per sq. in.
- Span of beam = 18 ft.
- Uniformly distributed load.

Stirrups to extend distance $(x) = 4.4$ ft. from end of beam.

From Chart F:

Given
- Unit shear at end = 83 lbs. per sq. in.
- Unit shear 2 ft. out $= 83\left(\dfrac{9-2}{2}\right) =$ 64.5 lbs. per sq. in.
- $b = 16$ in.

Assume 1/4-in. round "U" stirrups.

Stirrup spacing at end = 2.6 in., use 2.5 in.

Stirrup spacing 2 ft. out = 4.5 in., use.

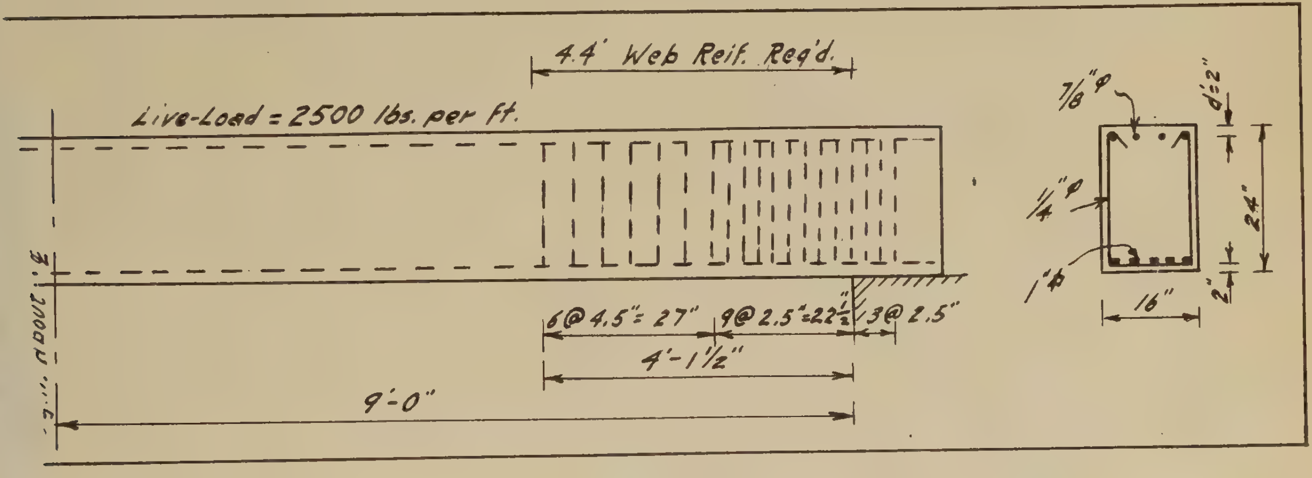


Figure 1-H

omplete details, as designed, are shown in Fig.

al Solution

er to give a comparison and demonstrate the of the charts, the analytical solution will be ar as the determination of the tensile and com- eel.

. of beam $= \left(\dfrac{16 \times 24}{144}\right) 150 = 400$

Live-load = 2500

Total load = 2900 lbs. per ft.

an of 18 ft.:

ng moment $= \left(\dfrac{w\,1^2}{8}\right) = \dfrac{2900 \times 18^2 \times 12}{8} =$ 1,440,000 in. lbs.

End shear $= \dfrac{w\,1}{2} = \dfrac{2900 \times 18}{2} = 26{,}100$ lbs.

Assumed section, $b = 16$ in., $d = 22$ in.:

$M_1 = Kbd^2 = 138.7 \times 16 \times 22^2 = 1{,}070{,}000$ in. lbs.

$A_{s1} = pbd = 0.0089 \times 16 \times 22 = 3.13$ sq. in.

$M_2 = M - M_1 = 1{,}440{,}000 - 1{,}070{,}000 =$ 370,000 in. lbs.

For $d' = 2$ in.

(Eq. 1-G) $f'_s = 30{,}000\ (0.4 - 2/22) =$ 9,270 lbs. per sq. in.

(Eq. 2-G) $A'_s = \dfrac{M_2}{f'_s\,(d - d')} = \dfrac{370{,}000}{9270\ (20)} =$ 1.995 sq. in.

(Eq. 3-G) $A_{s2} = \dfrac{M_2}{f_s\,(d - d')} = \dfrac{370{,}000}{18{,}000\ (20)} =$ 1.03 sq. in.

Total tensile steel $= A_{s1} + A_{s2} = 3.13 + 1.03 =$ 4.16 sq. in.

Four 1-in. sq. bars = 4.00 sq. in.

Five 1-in. sq. bars = 5.00 sq. in. (Use)

Total compression steel $= A'_s = 1.995$ sq. in.

Three 7/8-in. rd. bars = 1.80 sq. in.

Four 7/8-in. rd. bars = 2.41 sq. in. (Use)

It will be seen, from the above problem, that there is a slight variation between the individual quantities, but the results at the end are the same in both solutions.

Construction of Chart H

The two equations to be solved on Chart H

$$M_2 = A'_s\, f'_s\, (d - d') \qquad \text{Eq. 2-G}$$
$$M_2 = A_{s2}\, f_s\, (d - d') \qquad \text{Eq. 3-G}$$

have two variables, (M_2) and $(d - d')$, in common and the remaining two are very similar. When the compression steel stress is used, Eq. 2-G, the area of compression steel is obtained. When the tensile steel stress is used, Eq. 3-G, the area of additional tensile steel is obtained. So these two equations might be combined into a general equation:

$$\frac{M_2}{\text{(Area of additional steel)}} = \text{(Unit steel stress)}\ (d - d')$$

In transposing this equation into a form suitable for nomographic construction it must be remembered that the quantities (M_2) and $(d - d')$ will be identical, for any given beam, in both solutions. They should then be kept together.

$$(\text{Area of additional steel})\ (\text{Unit steel stress}) = \frac{M_2}{(d-d')}$$

This is a four-variable equation so must be divided into two three-variable equations with a common variable (y).

$$y = \frac{1}{(d-d')}\,(M_2) \qquad (1)$$

$$y = (\text{Area of additional steel})\ (\text{Unit steel stress}) \qquad (2)$$

Both expressions (1) and (2) correspond to the general equation, Eq. 7, requiring logarithmic co-ordinates. The nomograph for expression (1) will have values of (y) on the central (C) scale, values of $(d-d')$ on the left (L) scale, and values of (M_2) on the right (R) scale. Using the A-10 scale for values of $(d-d')$ and the A-5 scale for values of (M_2), the ratio (r) becomes

$$r = \frac{\text{size of } R \text{ co-ordinates}}{\text{size of } L \text{ co-ordinates}} = \frac{1}{2}$$

Equating the general exponents of Eq. 7

$$C = L^{mn/r} \, . \, R^{m(1-n)} \qquad \text{Eq. 7}$$

to the actual exponents of expression (1) and substituting the above value of (r), we have

$$\left.\begin{aligned} \frac{mn}{r} = \frac{mn}{\frac{1}{2}} &= 1 \\ m(1-n) &= 1 \end{aligned}\right\}$$

When solved simultaneously these two expressions give the values:

$$\left.\begin{aligned} n &= \frac{1}{3} \\ m &= \frac{3}{2} \end{aligned}\right\}$$

The value of $n = \frac{1}{3}$ indicates that the central scale will be one-third the distance from (R) to (L). The value $m = \frac{3}{2}$ indicates that the co-ordinates on the (C) scale will be two-thirds the size of those used on the (R) scale. This will necessitate the use of the K-5 scale for values of (y) on the (C) scale. Since values of $\left(\frac{1}{d-d'}\right)$ are to be plotted, the co-ordinates on the (L) scale will progress down the page. Figure 2-H shows the relative spacing and size of co-ordinates just found for expression (1).

In order to avoid the use of co-ordinates on the (y) scale, so it can act as a support in the final four-variable nomograph, the K-5 scale must be figured as being used for values of (y) in the second nomograph. Several trials were necessary before a desirable spacing was found that would superimpose on Fig. 2-H. Assuming the value $(m = 3)$ for the graph of expression (2), the co-ordinates on the (R) scale must be three times the size of those used on the (C) scale. This will necessitate the use of the A-10 scale for values of (Additional Steel Area). Equating the general exponents of Eq. 7 to the actual exponents of expression (2) and substituting the assumed value of $(m = 3)$, we have

$$\left.\begin{aligned} \frac{mn}{r} = \frac{3n}{r} &= 1 \\ m(1-n) = 3(1-n) &= 1 \end{aligned}\right\}$$

When these expressions are solved simultaneously, the following values are obtained:

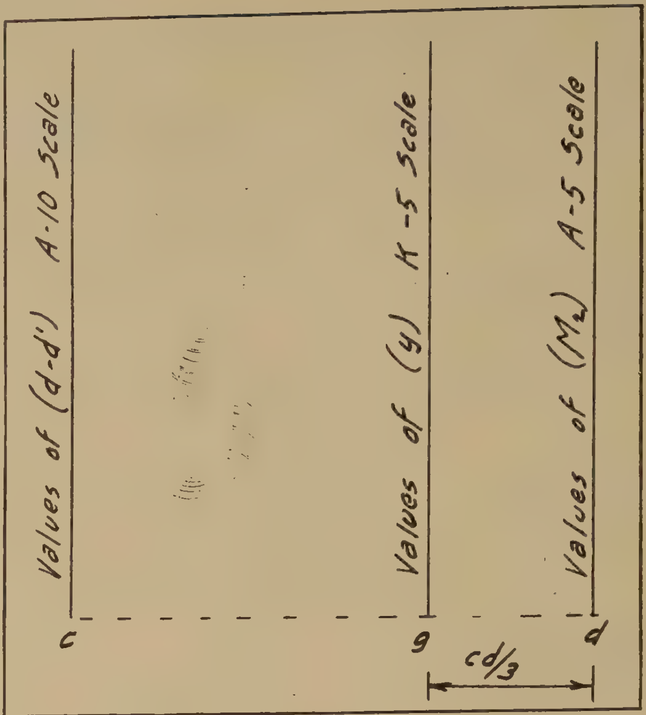


Figure 2-H

$$\left.\begin{aligned} n &= \frac{2}{3} \\ r &= 2 \end{aligned}\right\}$$

Thus the central (C) scale will be two-thirds the distance between the (R) and (C) scale, and the co-ordinates on the (L) scale will be one-half the size of those used on (R). This condition will be satisfied by using the A-5 scale for values of (Unit steel stress). The complete relations for the nomograph of expression (2) are shown in Fig. 3-H.

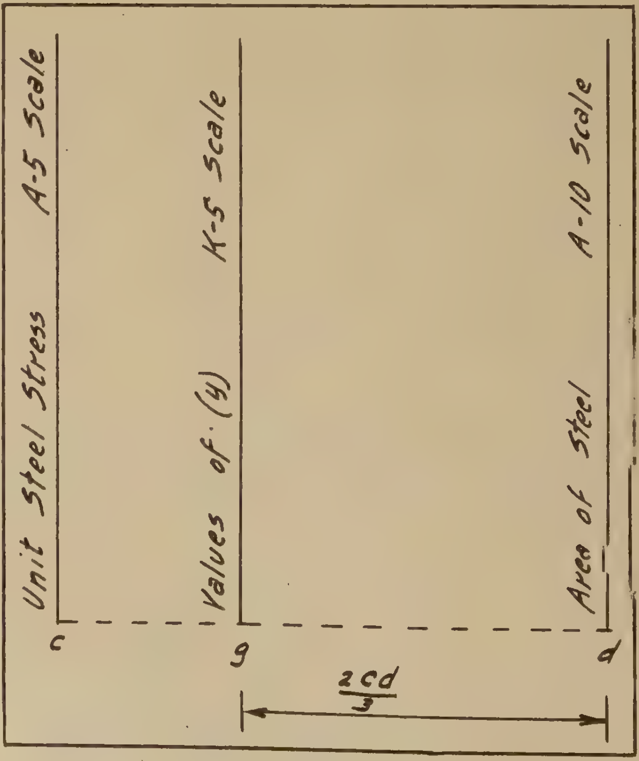


Figure 3-H

Superimposing Fig. 3-H on Fig. 2-H so that the central scale of each nomograph will fall on a common line, the co-ordinates of this central scale may be omitted and the line used as a support. The construction isopleth used, Fig. 4-H, is in reality two distinct isopleths. Scales (*A-A*) are used together for one isopleth, and scales (*B-B*) together. The unit steel stress at the construction isopleth was assumed as (100), but in the final chart, Chart H, the values below (1000) were omitted. Fig. 4-H gives the complete details by which Chart H was constructed.

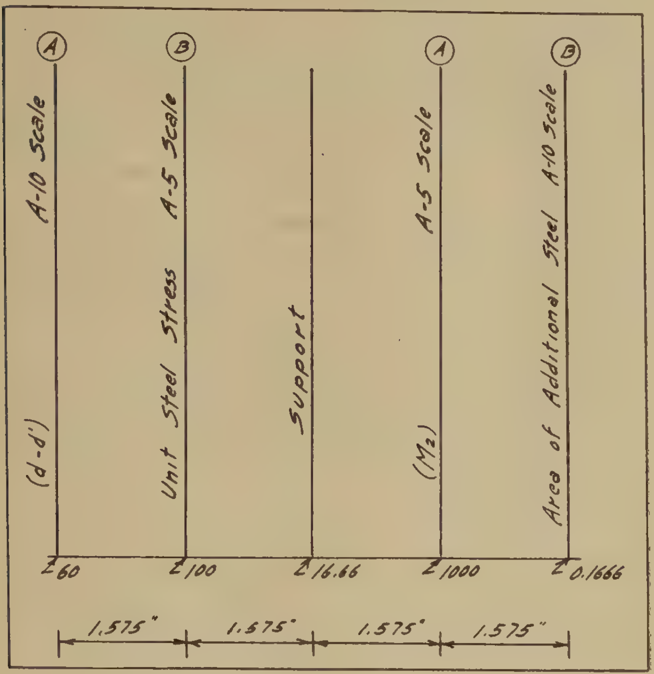


Figure 4-H

It will be noted that in using Chart H it is a distinct advantage to have the variables $(\frac{1}{d-d'})$ and (M_2) together. The intersection of isopleth (1) with the support is then a common point, for any one beam, for any variations of steel stress and its accompanying steel area.

Measurement of Elastic Strains in Concrete Structures

A test has been made recently to determine the practicability of a method which could be used in field tests of concrete structures for distinguishing between the elastic strains produced by stress and those resulting from changes in temperature and humidity and from plastic flow or yield. In this method small blocks of concrete are cut out of the structure; measurements are made of the elastic recovery which takes place in these blocks as they are relieved from the forces acting when in the mass. The changes in strain accompanying the removal of the blocks were determined readily by means of a hand strain gauge. To facilitate the removal of the blocks it was suggested that each should be cast in a U-shaped trough or form. The principal object of the test was to determine whether the presence of the form material would appreciably affect the strains in the block and whether the block could be cut without injury to the gauge lines.

A concrete prism 30 by 30 in. in cross section and 36 in. in height was made for the test. The prism contained one removable block near the mid-point of each of the four lateral faces. Each block was in the form of a prism 5 by 5 in. in cross section and 20 in. in height. One of the forms for shaping the blocks was made of sheet metal about 0.03 in. in thickness. The other three were made of wall board of three different thicknesses. All were given a thin coat of paraffin to prevent bonding with the concrete. Plugs were set in the concrete for use in taking strain gauge readings in three gauge lines on each lateral face of the prism, one gauge line being in the removable block and the other two midway between the edges of the block and the prism.

The prism was placed in a testing machine and a compressive load of 600 lbs. per sq. in. applied. After taking strain readings one of the blocks was removed by cutting the concrete along each end of the block. Although this required a cut about 5 in. in length and 5 in. in depth along each end of the block, these were made easily with a small air drill. The load on the prism was then released and strain-gauge readings were made. The same operation was followed in removing another block from the prism.

The results of the tests indicate that the blocks when separated (except at the ends) from the prism by thin forms, were cut out without a noticeable injury to the gauge lines. It was found, however, that the strain in the block cast into the sheet-steel form was only about 70 per cent of the average strain in the adjacent gauge lines, whereas for the blocks cast into wall-board forms the strains were on the average about 30 per cent greater than in the adjacent concrete. These results indicate that some provision should be made when using metal forms to prevent the steel from taking such an appreciable amount of stress as to affect the strain in the concrete block. They show further that wall board, on account of its greater thickness and lack of rigidity, is not a suitable material for such forms. Apparently the method can be made practicable for separating the elastic from the inelastic strains measured in concrete.

Coming Conventions

American Concrete Institute—February 12th to 14th. Twenty-fifth annual convention, at the Book-Cadillac Hotel, Detroit, Mich.

American Concrete Pipe Association—Feb. 14th to 16th. Annual convention, at the Book-Cadillac Hotel, Detroit, Mich.

American Road Builders Association—January 14th to 19th. Convention and road show, at the Cleveland Public Auditorium, Cleveland, Ohio.

Association of Cast Stone Manufacturers—Febuary 13th. First annual meeting, at the Book-Cadillac Hotel, Detroit, Mich.

National Concrete Products Association—February 11th. Annual convention, at the Book-Cadillac Hotel, Detroit, Michigan.

Nebraska Concrete Products Association—January 24th. Annual meeting, at the Lincoln Hotel, Lincoln, Nebr.

Northwest Concrete Products Association—January 25th and 26th. Fourth annual convention, at the Eugene Hotel, Eugene, Oregon.

Wisconsin Concrete Products Association—January 10th and 11th. Annual convention at the Hotel Plankinton, Milwaukee.

From the Products Associations' Bulletins

Northwest Concrete Products Association

F. R. ZAUGG, Secretary

PLANS for the fourth annual convention of the organization are announced in the bulletin dated November 1st and members of committees are listed. This year's meeting will be held at Eugene, Oregon, on Friday and Saturday, January 25th and 26th.

The Traffic Committee of the national Concrete Pipe Association is gathering data from manufacturers all over the country, the bulletin states, in order to present the matter of reduction of freight rates on concrete pipe at the next hearing. Members are urged to provide individually the information requested from them, particularly since they are directly financially interested.

The following description of an installation made by a member company is taken from this bulletin word for word as being of more than local interest.

"The Western Concrete Pipe Co. of Tacoma have just completed the installation of over 2 miles of centrifugal cast reinforced concrete pipe for the City of Tacoma, Water Department, on their Green River Gravity Water Supply line.

"The pipe was made in Tacoma and shipped about 35 miles by rail to the installation place near Enumclaw. There is 7010 ft. of 51-in. inside diam. pipe with 4¼-in. shell and 7542 ft. of 63-in. inside diam. pipe with 5¼-in. shell. The pipe is the tongue end groove type with a precast centrifugal collar grouted in place. The lengths are 8 ft. each and weigh approximately 3 ton and 4½ ton, respectively.

"The line was tested out under approximately 60 ft. head and was found very satisfactory. Less than 70 per cent of the allowable leakage was registered and indications point to the fact that a good portion of this was made up in absorption in the line, which had been wet only a few hours before testing. City officials are pleased with the installation and future rebuilding of other portions of this 42 mile line will undoubtedly be centrifugal concrete."

Wisconsin Concrete Products Association

JACK FRANKLIN, Secretary

"PROFIT" is the highly interesting title of an equally interesting little article in the October issue of the "Digest." Turnover and type of equipment are maintained to be determining factors.

The item says, "The largest profits are secured by a manufacturer who turns his money over in sales the greatest number of times. The manufacturer with a small daily output but selling well up to his capacity will make much more profit than the owner of a larger plant turning over his product only three or four times a year. The small plant may have a higher unit cost and sell at the same price, too.

"There is much for the concrete products manufacturer to learn about modern merchandising of his products. Suppose the small manufacturer makes a net profit on his product of 1 per cent but has a turnover twelve times a year—his net profit is 12 per cent. The large manufacturer with double the production but a turnover of only four or five times a year makes less profit on the basis of the same net profit per unit.

"Concrete products manufacturers of today have found their greatest development through the adaptation of the new mechanical inventions which have been devised to reduce production costs. The old order has passed. One man with the aid of some new machinery is able to do ten times the work he formerly did under old-fashioned methods."

On the editorial page appears a short item under the title "Photographs and Products"—a subject on which little stress has been laid recently. Wisconsin products manufacturers are urged to show actual jobs, particularly of unusual uses of their products.

This is followed by a report by "Spec" Collins of the activities and plans of the executive committee of the association for the 1929 convention. The gathering will be held in Milwaukee on January 10th and 11th and a program said to more than earn the high repute of previous ones is promised.

Talking plant practice, the "Digest" gets onto the subject in which Milwaukee manufacturers seem to have had some experience. It says, "In Milwaukee, as winter draws near, many manufacturers build up their stocks of twelve and eight-inch block. The eight-inch block is not what could be called a standard unit in Milwaukee, but when two eight-inch block are laid side by side and bonded every third or fourth course, they build a sixteen-inch wall. Or when laid with a twelve-inch block they make a twenty-inch wall.

"The reason Milwaukee manufacturers build large stocks of these particular units is that they find them easier to sell during the winter, as a substitute for monolithic concrete, than in the summer."

Nebraska Concrete Products Association

ROGER MERRITT, Secretary

THE November bulletin reports on the Home Modernizing Bureau as now being established at Lincoln. A budget of $6,000 to cover six months' activities has been suggested and each of the allied interests are securing subscriptions for their apportioned share, it is stated.

Omaha is also said to have decided to establish a local bureau and is to raise a campaign fund of $30,000 to carry it for one year.

"Concrete products men, if they thoroughly understand this Home Modernizing program, will certainly get back of it to the fullest possible extent." Then follows an account of an instance in which a property owner increased his property's value by almost 25 per cent.

"Among the twenty-one items of work done there were several which immediately concern manufacturers of concrete products. These are basement walls built of concrete masonry, and concrete front and rear steps. It is possible that other concrete products were involved, for example, in such operations as a new sewerage connection.

More than a page is devoted in this issue of the Nebraska publication to an article by H. D. Jolley of the Concrete Engineering Company of Omaha picturing what can be accomplished for concrete and concrete products by live promotion, as exemplified by an instance of which he had first-hand knowledge.

Painless Bookkeeping For Products Plants

The Third Article of a Series on a Simplified Method of Keeping Products Plant Records—Bookkeeping Methods Are Explained in This Article

By F. W. SCHNOEBELEN

Part III—Bookkeeping Methods

IN this, the third article of this series, the author explains the fundamental principles of bookkeeping. This is done at this point because succeeding articles will show how these principles are applied to the practical, everyday work of keeping records in a concrete products plant.

The preceding articles presented simple, concise methods for keeping the production and sales records. How these will be used and handled so as to reveal the important facts that the products manufacturer must have at his fingers' ends, will be explained in succeeding articles.

It is important that the facts presented in this installment be understood, for on them rests the value that will be gotten from the balance of the series.

BOOKKEEPING may be defined as the process of recording the financial facts regarding a business in systematic order. When these facts are recorded properly, they present a complete day-to-day story of the status of the business.

It is not necessary then to wait till the end of the year before it is possible to tell whether the business is making or losing money. Each day we may know, if we so desire, how much has been spent for raw materials, what expenses have been incurred, what cash has been received and paid out, what is the present volume of sales for any period, what is the record of transactions with our creditors, etc. An accurate statement of conditions is always available.

Double Entry Bookkeeping

There are two methods of bookkeeping in use—the single entry and the double entry. The single entry system does not furnish a complete record, only showing the cash received, cash paid out, and the transactions with customers and creditors.

The double entry method is much more satisfactory and should be adopted by the concrete products manufacturer. It is based on the principle that each transaction involves an exchange of equal value and the books must show the value received (either property or service) and the value owed (either property or service given in return).

A transaction will affect an account in two ways—either as a debit or as a credit. An account is a record of a transaction with any one person, any one kind of property, service or revenue collected under a single heading. Any of the items listed in Exhibit C are termed accounts.

An account is divided into two sides, the left hand side termed the debit or charge and the right hand side termed the credit. The ruling on each side is generally the same. The illustration below is an example of an account.

The account on the left hand side under debits indicates that $900.00 has been deposited in the bank. Likewise it is charged to the bank. On the right hand side is the credit, the amount of the checks that have been withdrawn from the bank. The difference between the debits and the credits is termed the balance, which is $100.00. The balance being a debit, indicates that you still have $100.00 in the bank. If the credit side would be larger, it would indicate that you were overdrawn at the bank.

EXAMPLE OF LEDGER SHEET

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NAME—The City National Bank.
ADDRESS—Washington Street

	Debits					Credits			
1929 Jan. 31	Deposits	C.B. 6	900	00	1929 Jan. 31	Checks	C.B. 6	800	00
Year Month Day	Any special explanation deemed necessary by the bookkeeper.	Page of Book of Original Entry	Dollars	Cents	Year Month Day	Any special explanation deemed necessary by the bookkeeper.	Page of Book of Original Entry	Dollars	Cents

C.B. 6 indicates that the amount shown on the bank account was posted from page 6 of the Cash Book. Posting is transferring the amount from the books of original entry to a corresponding ledger account. The books of original entry are termed the Cash Book, Accounts Payable and Distribution Record and the Sale Journal. These will be taken up in detail later. Other examples of ledger accounts would be as follows: The difference between the total charge to a customer, as shown by the debit side of his account, and the total credit, as shown by the credit side, is the balance he owes. The balance of any account will show an asset, a liability, a profit or a loss.

Definition of Terms

An asset is any property belonging to the business. All the property belonging to the business constitutes its assets, which may consist of cash or any property that may be turned into cash, merchandise, the finished goods in stock, notes, written promises of others, personal accounts, the amount due from customers and good will.

All the debts owed by the business are its liabilities. They may consist of personal accounts, amounts due to others, or may be in the form of notes, or written promises, to pay others.

A profit is an increase in the net worth of the business. On the other hand, a loss is a decrease in the value of the net worth. The net worth of a business is the difference between the assets and the liabilities.

The rule of double entry bookkeeping is that debits and credits must be equal. That is, if we debit one account we must always credit another account for the same value. It follows logically then, that all asset accounts should have debit balances and that all liability and capital accounts should have credit balances.

In Exhibit C you will find that there are asset accounts, liability and capital accounts, revenue or income accounts and operating or expense accounts. The following rules hold true in every transaction:

Asset and Expense Accounts:
  Debits record increases.
  Credits record decreases.
Liability, Capital and Income Accounts:
  Debits record decreases.
  Credits record increases.

Assets and expense accounts are represented with debit balances and the liabilities; capital and income accounts with credit balances. It then follows that the sum of the assets and the expenses are equal to the sum of the liabilities, capital and income accounts in the general ledger. As mentioned before, each transaction affects at least two or more accounts. It is necessary first, however, to determine the accounts that are affected by the transactions. One or more accounts may show the value of the property or services received, and one or more the value of the property or services exchanged.

The general rule for debits and credits, as laid down by all accounting books is debit the account which represents the value received and credit the account which represents the value given. By studying the following table, there will be no difficulty in understanding the law of debits and credits.

Debit the Account which represents:

1. The cash received or property purchased.

3. The parties to whom cash is paid or property is sold on account.

5. The services for which cash or other property is given in payment.

Credit the Account which represents:

2. The cash paid or property sold.

4. The parties from whom cash is received or property is purchased on account.

6. The service for which cash or other property is received.

Business transactions are generally classified into four groups as follows: (1) cash, (2) credit, (3) payment of a debt and (4) service. All transactions are first recorded in what is known as the books of account. These consist of the books of original entry, the ledger and the auxiliary books which contain the detailed information supporting the general ledger accounts.

In order to prove that our books are in balance, i. e., that there is an equality of debits and credits, we take a trial balance. It consists of a list of the open accounts in the ledger, in which the total debits must be equal to the total credits.

The ledger contains more or less permanent accounts with assets, liabilities and capital and the temporary accounts such as income and expense. Exhibit C is the classification of accounts for concrete products manufacturers. It contains the necessary accounts for the general ledger and those for the subsidiary ledgers.

Explanation of Accounts

Assets are the first group of accounts in the general ledger. Their purpose is to indicate the value of the property belonging to the business. There are two kinds of assets—current and fixed. Current assets show the value of the property acquired through the purchase and sale of commodities in which the business deals, such as Cash, Accounts Receivable, Notes Receivable, Inventories and Investment. Fixed assets are the values of property bought for use in business, such as Real Estate, Building Equipment and Goodwill.

For those who are not familiar with the transactions that refer to each account, a brief summary will be made.

The cash account shows a record of all the transactions in which cash is received and paid, and the balance on hand. It is best to have two accounts for cash, one for the petty cash, which is the amount used for incidentals paid in currency, and one for cash in the bank, through which the bulk of the cash transactions are handled.

Accounts Receivable is a term used to represent the total amount due from regular customers of the business. It is called a controlling account in the General Ledger which means that there is a subsidiary ledger in which the individual accounts with customers are kept. To keep all the customers' accounts in the General Ledger would make it too unwieldy. When the trial balance has been taken from the General Ledger, the accounts in the subsidiary ledger are checked with the controlling account.

Notes Receivable accounts show the amount due the business by written obligations. It is also a control account, having an auxiliary book or a Notes Receivable Record where the detailed information relative to each note is kept. This information includes the date, the name of the person from whom the note is received, the endorser, bank where payable, date of issue, when due and paid or discounted.

Inventories is a list of the finished goods and raw materials belonging to the business at the close of the fiscal period. It includes the cost of the materials delivered. Freight charges should always be included in the value. In the Inventory Accounts the amount is recorded only. An inventory book is kept where the materials are listed in detail. In a later issue we will deal at length with inventory records.

Investments, such as stocks, bonds and mortgages, show the amount or value of the securities owned by the business. If these are numerous it is best to make control ac-

EXHIBIT C

The chart below will be found very useful for reference by anyone learning bookkeeping, who needs an occasional guide

DEBITS	CREDITS
For all the cash received.	For all the cash paid out.
For all deposits in the bank.	For all checks written on the bank.
For all sales on charge accounts.	For goods returned to you, allowance made by you and payments received by you, cash or credit.
For all notes received by you.	For all notes settled to you or disposed of by you.
For the cost of all goods on hand at the beginning of the business and for value of all goods on hand at the end of the fiscal period.	For the cost of goods on hand at the beginning of the business at the close of each fiscal period.
For the cost of all investments.	For the selling price of all investments.
For the cost of all land acquired.	For the sale price of all land sold by you.
For the cost of all buildings acquired and improvements made by you.	For the sale price of all buildings disposed of and depreciation written off.
For the cost of all equipment.	For the sale price of all equipment or depreciation written off.
For the value of expenses paid in advance.	When the books are closed for the period transfer to a proper service account.
For the value acquired when a change in ownership is made.	No credit unless written off against the profits.
For goods returned to you, allowance made by you, payments made by you, cash or credit.	For purchases on charge accounts.
For notes redeemed by you.	For notes settled to you or disposed of by you.
Not charged until the books are closed.	For the amount accrued, but not yet due for general services rendered to business.
Bonds redeemed by you.	Bonds issued by the business.
When the items become due.	When the item is paid or collected in advance.
For the cost value of the equipment discarded.	For the amount of depreciation set aside each period.
When the accounts are worthless.	With a percentage of the accounts received considered uncollectible.
For withdrawals, cash or merchandise.	Regular salary allowance.
For withdrawals of capital from business.	For investments in capital in business.
With any allowances or adjustments made by you, cash or otherwise.	For the amount of sales on finished goods made by you. With the selling price of any asset, the amount of all interest earned on money loaned and with the amount of discounts earned on purchases.
For the cost of all expenses incurred in running the business by you, the amount of discount allowed on sales and the amount of returned sales and allowances.	With any rebates or allowances on expense made to you or any readjustments.
For the cost of all goods purchased, including freight.	For the cost of goods returned by you and all allowances made to you.

counts and keep an investment record in which the detailed information is recorded.

The Real Estate account records show the cost of the land purchased by the business. If there are buildings on the land at the time of purchase, a separate value is placed on each.

The Buildings account shows the cost of structures on the land owned by the business. It should show the value fixed at the time of purchase, the cost of any additional buildings, and the amount paid for improving, but not for keeping the buildings in repair. For instance, if a new floor of the same material is put in the building, this does not increase the value of the building because it was needed in order that the building could be used. If the original floor was made of wood, and concrete is used for the new floor, this increases the value of the property, and the difference between the cost of the two kinds of material should be charged to the Building account.

The Equipment account shows the cost of property purchased for use in the business. At least four accounts should be provided for equipment:—Machinery for the factory, such as concrete block machines, mixers and handling equipment, Delivery Equipment such as trucks, Selling Equipment such as a salesman's car, and Office Equipment such as typewriters, adding machines and all other miscellaneous equipment used in the office.

Prepaid Expense accounts show the expense incurred in one fiscal period which is chargeable to the following period, such as insurance and taxes. This account is not opened until the end of the period and is closed immediately after the books are closed.

Goodwill is considered an asset of the business and is created when a change in ownership is made. It is brought about by the reputation of the business, the trade mark or the reputation of the goods sold on which a value is placed.

Liabilities and Capital

The second group in the classification are the liabilities and the capital accounts. Liabilities are the amounts owed by the business such as Accounts Payable, Notes Payable, Accrued Expenses, Bonds Payable, Deferred Credits, Reserves for Depreciation and Bad Debts.

Accounts Payable is a term used to represent the total amount due the regular creditors. For instance, it includes those creditors from whom you buy cement, sand and gravel and supplies. This is a control account and is handled in the same way as the accounts receivable.

Notes Payable lists the written obligations owed by the business such as notes given for working capital and for the purchase of additional capital. This is also a control account with a Notes Payable Auxiliary Record.

Bonds Payable records the amount of the bonds issued by the business for financing, and are considered a long-term-debt.

Accrued Expenses show the amount of liabilities accrued, but not yet due for service rendered to the business. This includes general expenses, payroll, and taxes accrued and not paid, also interest owed on outstanding notes and accounts and other unpaid obligations not shown by an account in the ledger.

Sometimes interest or other income is collected in one fiscal period, but is not due till the following period. The account in which this is recorded is called Deferred Credits. It is not opened until the end of the fiscal period and is closed immediately after the books are closed.

Reserve for Depreciation accounts show the estimated decrease in value of all property purchased for use in the business. The life of any equipment is limited. It either becomes useless through wear and tear or becomes obsolete. It is essential that a certain share of the profits should be set aside to replace the equipment that becomes useless. This should not be done in one year, but should be spread over the period of the life of the machine. The amount that you set aside to replace the capital investment in property used in the business is called a Reserve for Depreciation. We should have as many accounts for reserves as we have different types of equipment because the life varies in each instance and a different percentage must be set aside.

Numbering Scheme for the Classification of Accounts for Concrete Products Manufacturers

GENERAL LEDGER

Accounts

1. Assets
    - 10.—Cash
        - 100.—Petty Cash
        - 101.—Bank Account
    - 11.—Accounts Receivable
    - 12.—Notes Receivable
    - 13.—Inventories
        - 130.—Finished Goods
        - 131.—Cement
        - 132.—Sand and Gravel
        - 133.—Miscellaneous Material
    - 14.—Investments
        - 140.—Stocks
        - 141.—Bonds
        - 142.—Mortgages
    - 15.—Real Estate
    - 16.—Buildings
    - 17.—Equipment
        - 170.—Machinery, Factory
        - 171.—Truck, Delivery
        - 172.—Auto, Selling
        - 173.—Office
    - 18.—Prepaid Expenses
        - 180.—Unexpired Insurance
        - 181.—Taxes
    - 19.—Good Will
2. Liabilities and Capital
    - 20.—Accounts Payable
    - 21.—Notes Payable
    - 22.—Accrued Expenses
        - 220.—Expenses
        - 221.—Pay Roll
        - 222.—Taxes
        - 223.—Interest
    - 23.—Bonds Payable
    - 24.—Deferred Credits
        - 240.—Interest Collected in Advance
    - 25.—Depreciation Allowances
        - 250.—Reserve for Depreciation of Machinery
        - 251.—Reserve for Depreciation of Office Equipment
        - 252.—Reserve for Depreciation of Trucks
        - 253.—Reserve for Depreciation of Automobiles
        - 254.—Reserve for Depreciation of Buildings
    - 26.—Reserve for Bad Debts
    - 27.—Proprietors' Personal Accounts
    - 28.—Proprietors' Capital
        - 280.—Surplus
3. Income Accounts
    - 30.—Sales—Finished Goods
    - 31.—Discounts Earned
    - 32.—Interest Earned
    - 33.—Sales of Miscellaneous Assets
4. Expense Accounts
    - 40.—Manufacturing Expenses
    - 41.—Delivery Expenses
    - 42.—Selling Expenses
    - 43.—Administrative and Financial
    - 44.—Discounts Allowed
    - 45.—Returned Sales and Allowances
5. Purchases
    - 50.—Finished Goods
    - 51.—Cement
    - 52.—Sand and Gravel
    - 53.—Miscellaneous Material

SUBSIDIARY LEDGERS AND RECORDS

- LEDGER A.—Customers
    - Notes Receivable Record
    - Inventory Record
    - Investment Record
- LEDGER B.—Creditors
    - Notes Payable Record
- EXPENSE LEDGER—C
    - .— 1 Maintenance
    - .— 2 Pay Roll
        - .—20 Direct Labor
        - .—21 Indirect Labor
    - .— 3 Depreciation
    - .— 4 Insurance
    - .— 5 Taxes
    - .— 6 Rent
    - .— 7 Automobiles
    - .— 8 Supplies
    - .— 9 Salaries
        - .—90 Executive
        - .—91 Office
    - .—10 Miscellaneous
    - .—11 Advertising
    - .—12 Cartage
    - .—13 Heat, Light and Power
    - .—14 Collections and Credit
    - .—15 Interest Paid
    - .—16 Bad Debts
    - .—17 Commissions
    - .—18 Subscriptions, Dues and Donations
    - .—19 Professional Services

It is also customary to set aside a reserve for bad debts. A certain percentage of our accounts receivable each year are uncollectible and the way to provide for this loss is to set aside each month a certain amount as reserve.

The proprietor's personal accounts show the drawings or loans made on the business. The Proprietor's Capital account shows the amount invested in the business. The surplus account is to show the undivided profits. This is generally divided at the end of the year in the form of dividends.

The Income accounts show the income of the corporation, that is the amounts received from the sales of the manufactured products, or from the sale of assets or through investments. The average concrete products manufacturer can classify his income under the following accounts: The sale of finished goods, discounts earned, interest earned and the sale of miscellaneous assets. These accounts, of course, can again be subdivided if the accounts are to be kept in more detail.

In the manufacturing of concrete products, there are four major expense accounts: Manufacturing Expense, Delivery Expense, Selling Expense and Administrative and Financial Expense. These accounts are control accounts in the general ledger. Therefore a subsidiary Expense Ledger in which the detailed expense accounts are kept is provided. You will notice on Exhibit C the items listed under the Expense Ledger. These detailed accounts are necessary if we are going to have knowledge of the expenses. Other expense accounts that should be kept in the General Ledger besides the four mentioned are Discounts Allowed and Returned Sales and Allowances.

The Purchases accounts are general ledger accounts, which record the cost of all raw materials used in manufacturing the product. The average firm needs only a Finished Goods Account, the amount of finished products that we purchase from other plants, a cement account, a sand and gravel account and a miscellaneous account, where all the small items, such as calcium chloride, etc., are recorded.

Exhibit C is a posting chart which will be very useful to anyone learning bookkeeping. You will notice that there is a guide for main account in the General Ledger and all subsidiary accounts are explained in the same manner.

A numbering scheme for the accounts is also presented. Instead of writing out the name of the account in every transaction, it is necessary only to give the number of the account. This simplifies recording. By following through the scheme in Exhibit C and making a little study of it, you have little difficulty in grasping the scheme.

(The fourth article of this series will be presented in the January issue)

Concrete Stone Manufacturers Prepare for First Annual Meeting

Concrete stone manufacturers will attack their numerous problems with vigor when their national organization meets in conjunction with the American Concrete Institute on Wednesday, February 13th, at the Book-Cadillac Hotel, Detroit, Mich. The committee, composed of Louis A. Falco, chairman; C. G. Walker, secretary; C. Van de Bogart, Herman Frauenfelder, Duncan Thomson, M. A. Arnold, P. H. Bates, George J. Eyrick and Stewart McQuade, is co-operating with the A. C. I. program committee in developing a program for one entire session of the A. C. I. convention.

The Association of Cast Stone Manufacturers, organization of which was effected at the time of the A. C. I. convention in Philadelphia in 1928, has made, even in this short time, some progress in solving its problems. Standardization is generally recognized by progressive manufacturers as a necessity, since there is now far too wide a range of qualities and characteristics in the products sold under various trade or general names, but all, in the minds of many architects, having some claim to classification as concrete stone.

The situation is described as being such that a product claims confidence chiefly through the name and responsibility of its maker and not from any standardization of minimum quality or characteristics. The manufacturers are approaching their problem with the idea that what architects desire in cast stone is that it be durable, that it be permanently good-looking, and that it be dependably uniform in quality.

In the field work of the Institute's Committee, P-3, on Concrete Stone Specifications, it is proposed to study and analyze as many cast stone jobs as possible in order to ascertain why each particular job is satisfactory or unsatisfactory, as the case may be. When the resulting observations and data are assembled and correlated it is expected that some definite conclusions may be drawn.

The Association Committees on Organization and Specifications are laying a foundation for the work of the A. C. I. Committee. Both the Association Committees held a meeting in Boston, September 27th and 28th. Members of these committees are: Organization—W. D. M. Allan, Louis A. Falco, Herman Frauenfelder, Wm. P. Eddy and M. A. Arnold; Specifications—W. D. M. Allan, Herman Frauenfelder and Louis A. Falco.

It was unanimously agreed in these committee meetings that the standardization of cast stone was the most important matter now up for consideration and that steps should be taken immediately to get before architects, builders and contractors the information which is necessary for an intelligent choice of cast stone for any particular job.

Two broad classifications of cast stone were agreed upon as a basis for understanding and co-operation among the various manufacturers. "Cast stone" and "cut cast stone" are the two general terms which will be used to denote the differences in cast stone due to the manner and extent of finishing. It is the purpose of the association to expand each of these classifications in order to standardize finishes and give architects and builders a clear understanding of exactly what is involved in the various kinds of finishes.

The Committee on Specifications recommended to the A. C. I. Committee P-3, that compressive strength be not less than 3500 lb. per sq. in. at 28 days and that the absorption be not less than 3 per cent and not more than 7 per cent by weight of the dry specimen. These values for strength and absorption are being submitted to the membership of the association.

The Institute Committee, P-3, has the following membership: Louis A. Falco, chairman; C. G. Walker, secretary; C. Van de Bogart, Herman Frauenfelder, Duncan Thomson, M. A. Arnold, P. H. Bates, George J. Eyrick, Stewart McQuade.

Philadelphia Building Congress Gets Behind Winter Work

The year-round construction movement is receiving impetus from many quarters. One of them is the Philadelphia Building Congress, located at Philadelphia, Pa., and headed by prominent architects, contractors, and others interested in the building trades.

Among the Congress' activities in this direction is the publication of a folder presenting facts and figures on and illustrations of winter work.

Unusual Types of Reinforced Concrete Bridges

Design Features of Two Interesting European Bridges—Piers Inclined to Shorten Middle Span—Center Span of Continuous Beam Bridge Over 50 Feet

By H. G. SCHWEGLER, C. E.

IN a romantic part of the Black Forest, in South Germany, not far from the Swiss and French frontiers, two short railway bridges have recently been completed which are interesting in design.

The shorter one carries a one-track railway across the river Murg at about a 50 degree angle, and also on a grade of 0.25 per cent. The river at this point is about 45 feet wide and some 15 feet deep.

Factors governing the design of the bridge are roughly as follows: The rock is not far below the surface and consists of a very hard granite, giving an excellent foundation. The fact that the base of rail elevation is only about 7 feet above the high water mark, made it undesirable to use an arch construction of either steel or concrete. Timber was easily procured at a low cost, and also concrete aggregates were available in large quantities.

A design of reinforced concrete as shown in Figure 1 was decided upon. To shorten the middle span of this rigid frame, the columns or piers were inclined toward the center. The advantage gained by this construction is evident. It makes possible a considerable reduction in the depth of the main beam, as the beam and piers are designed as a unit. The angle of the columns or piers was determined by adopting the line of pressure for dead-load as the center of the columns.

Figure 2 shows the reinforcement of the rigid frame and the method of supporting the end span beams upon this frame. Special ½-in. sliding plates have been attached to the bottom of the beams and the top of the supports; this necessitated special reinforcing to take these concentrated loads. Figure 3 shows the finished bridge.

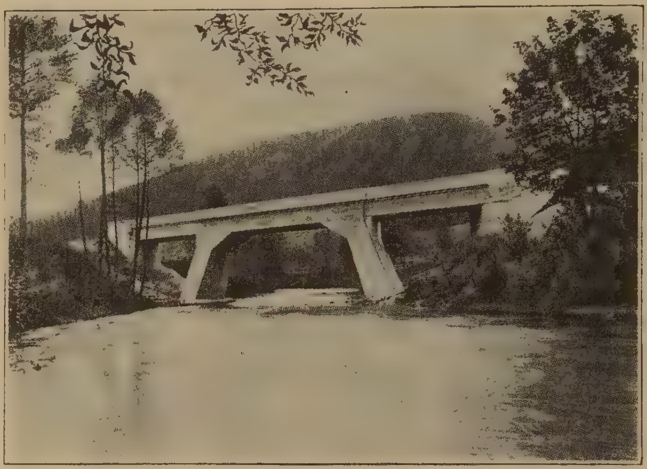


Figure 3

The second structure, of greater length, is located about 10 miles from the first one, and is of continuous beam construction for 5 panels. The panel ends are supported on piers and abutments. The center span is 50 ft. 7 in., which is a considerable length for a railway bridge of concrete.

Figure 5 indicates the method of supporting the continuous beam on the columns or piers. The arrangement

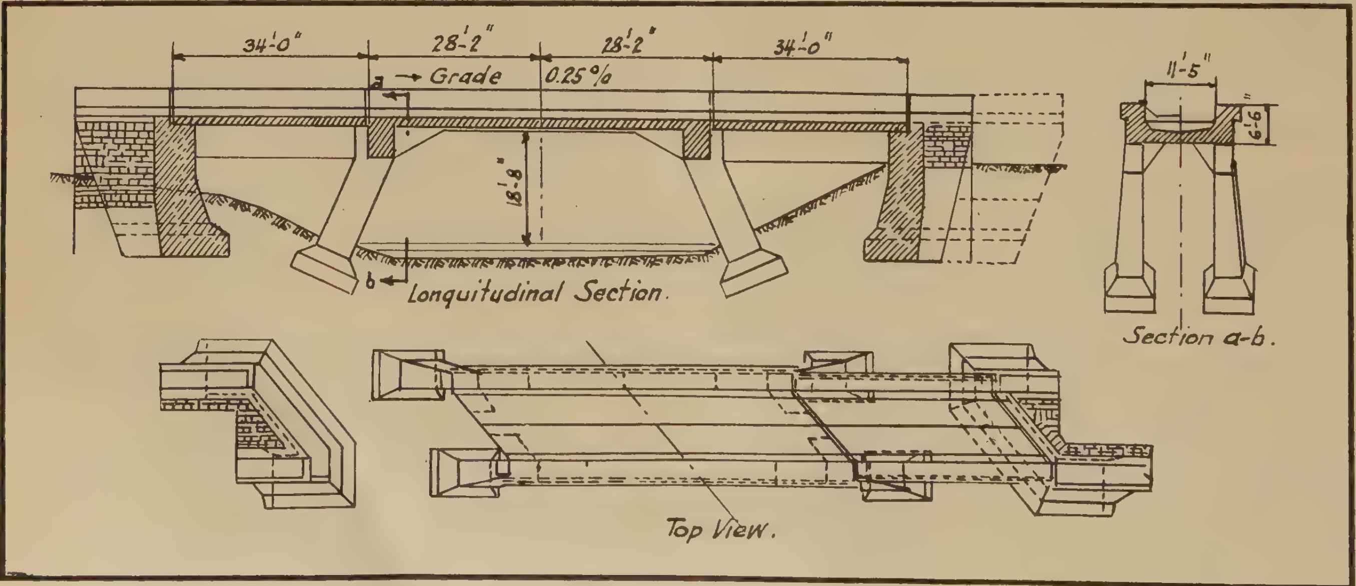


Figure 1

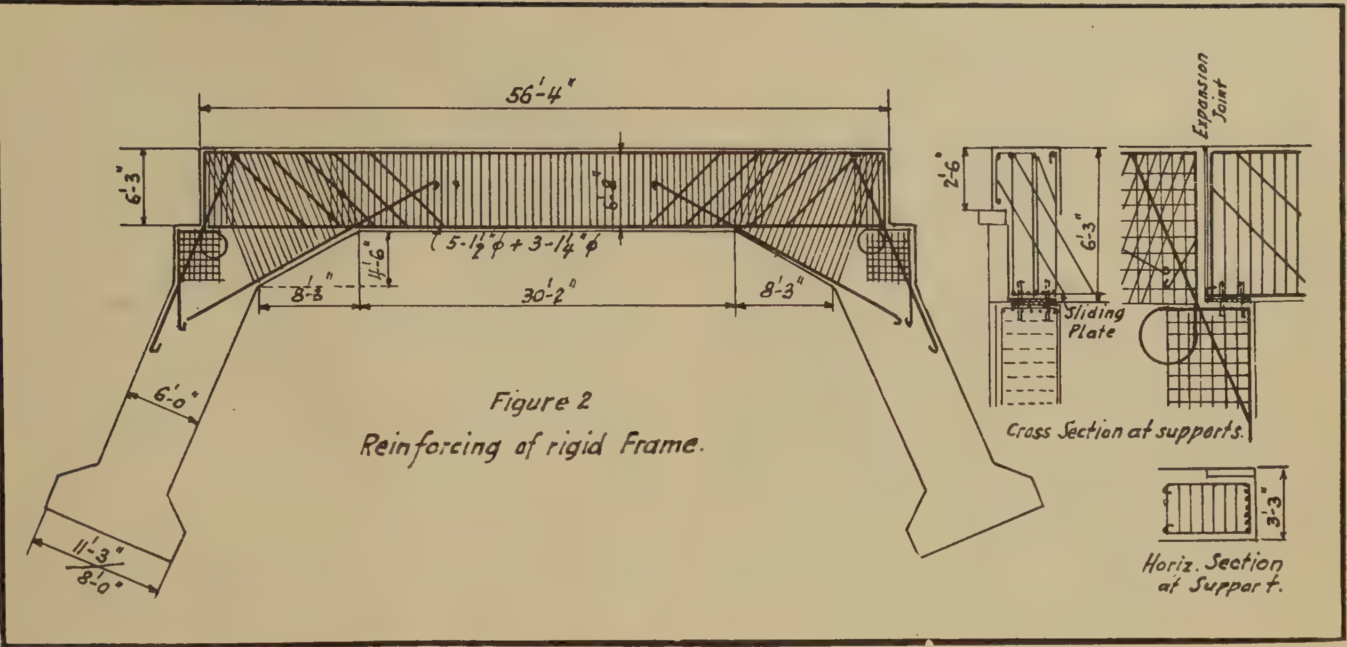


Figure 2
Reinforcing of rigid Frame.

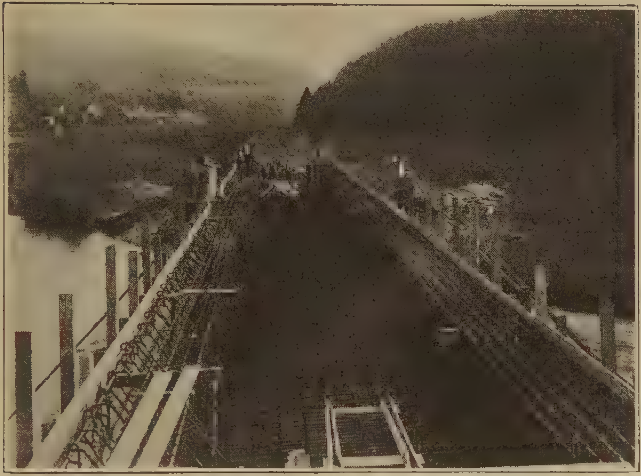


Figure 4

of steel plates anchored into both the beams and piers respectively provides for expansion, but necessitates special reinforcing steel as shown. The continuous beams of the 3 center spans are fixed by anchor bolts at the left pier and abutment. The right pier is designed at the base as a hinged column. This is shown by Figure 6. Figure 4 shows a photograph of the bridge during construction.

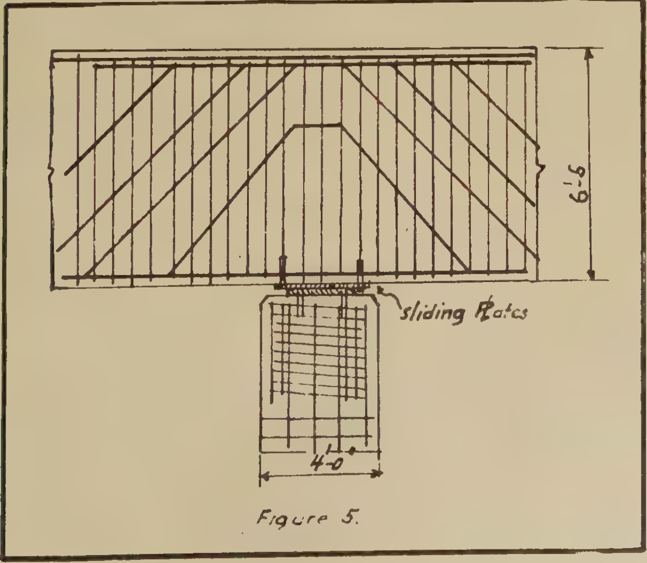
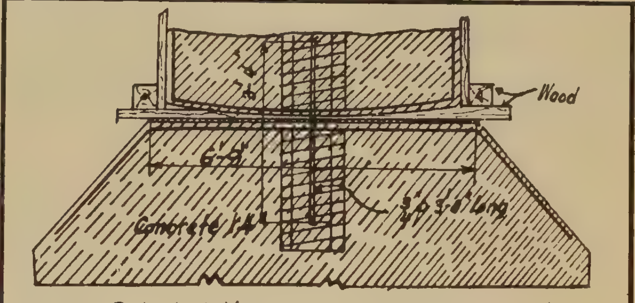


Figure 5.



Detail of Hinge at Bottom of Column (a)
Figure 6.

These two bridges are unusual because of their design and use. The loads applied are somewhat lower than would be necessary in this country, due to lighter construction of both locomotives and cars. However, they illustrate another field for the use of concrete. Both bridges have been completed and are in daily use. As yet they show no indications of faulty design and have a pleasant appearance.

Highway Research Board Meeting in December

Such topics as practical methods based upon sound research for taking care of unusual drainage and other subgrade conditions and for methods for design of pavements; factors to be considered in correlation of soil and pavement conditions; effect of width of roadway and various physical conditions upon carrying capacity will be brought up when the Highway Research Board holds its eighth annual meeting on December 13th and 14th at the National Academy of Sciences and National Research Council Building, Washington, D. C.

The Maryland aerial traffic survey between Washington and Baltimore, and methods used in promoting the financing of state highway systems, are other subjects that will be discussed.

Design of Concrete Mixtures

(Continued from page 14)

TABLE NO. 4

Recommended range of fineness moduli of mixed aggregate for various gradings and quantity of cement per cubic yard of concrete in place

Bags of cement per.cu. yd. of concrete in place	Grading of mixed aggregate							
	0 to 3"		0 to 2"		0 to 1½"		0 to 1"	
	Fineness Modulus		Fineness Modulus		Fineness Modulus		Fineness Modulus	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
4	5.80	6.40	5.50	6.00	5.10	5.60	4.70	5.20
4 1/2	5.80	6.50	5.50	6.10	5.10	5.70	4.70	5.30
5	5.80	6.60	5.50	6.20	5.10	5.80	4.70	5.40
5 1/2	5.80	6.70	5.50	6.30	5.10	5.90	4.70	5.50
6	5.80	6.80	5.50	6.40	5.10	6.00	4.70	5.60
6 1/2	5.80	6.90	5.50	6.50	5.10	6.10	4.70	5.70
7	5.80	7.00	5.50	6.60	5.10	6.20	4.70	5.80

The values on Diagram 1 and in Table 4 are based on the requirements for sand and gravel aggregates ordinarily used in concrete for heavy construction such as foundations, walls or heavy sections of reinforced concrete structures. For other materials and in other classes of engineering structures the maximum permissible values of fineness modulus for an aggregate of a given size are subject to the following corrections:

TABLE NO. 5

1. If crushed stone is used for coarse aggregate, reduce values by 0.25
2. If crushed stone contains flat or elongated particles, reduce values by 0.40
3. If stone screenings are used for fine aggregate, reduce values by 0.20
4. For concrete roads or pavements hand tamped and finished, reduce values by 0.25
5. For concrete roads or pavements machine tamped and finished, reduce values by 0.10
6. For reinforced concrete with thin walls or partitions, reduce values by 0.20

Sand with a fineness modulus less than 2.00 should not be used in concrete work.

Coarse aggregate should be well graded from 4-mesh or 3/8 in. to maximum size.

Problems Illustrating Use of Diagram

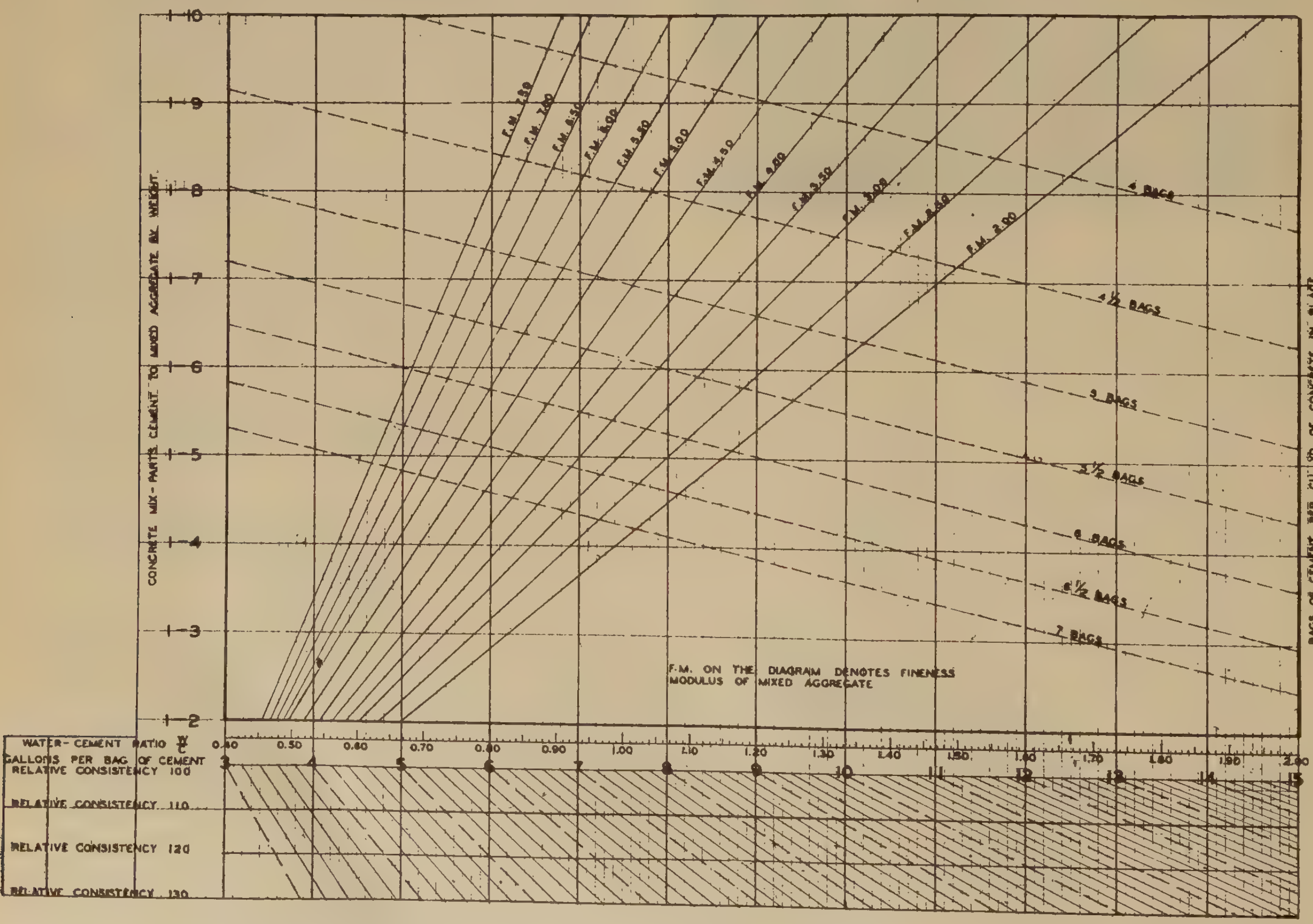
1. For a concrete mix using six bags of cement per cu. yd. of concrete in place, a mixed aggregate having a fineness modulus of 5.50 and specific gravity of aggregate 2.69 mixed to a relative consistency of 100, determine the following:

   (a) Parts of aggregate by weight to 1 part of cement by weight.

   (b) Water-cement ratio.

   (c) Gallons of water per bag of cement.

DIAGRAM 1



The values in the above diagram are based on dry aggregate. If the aggregate contains moisture, the quantity of water in the aggregate must be deducted from the values shown in the diagram. Specific gravity of aggregate 2.69

Referring to Diagram 1, the intersection of the lines "6 bags of cement" and "fineness modulus 5.50" is first found. Tracing vertically downwards from the intersection of said lines to the line of "relative consistency 100," the water per bag of cement is found to be approximately 6 gallons. Tracing vertically upwards the water-cement ratio is found to be 0.80. Trace vertically upwards either along the line denoting "6 gallons of water per bag of cement" or the corresponding value of water-cement ratio, namely 0.80, until it intersects the line denoting "6 bags of cement per cubic yard of concrete in place." From this last intersection of lines tracing horizontally to the left, parts of cement to parts of aggregate by weight is found to be 1:5.75.

2. A concrete mix is proportioned 1 part of cement to 4.4 parts of aggregate by weight. The specific gravity of the aggregate is 2.69 and water-cement ratio 0.90. Determine the bags of cement in the mix per cubic yard of concrete in place.

Referring to Diagram 1, the intersection of the lines "4.4 parts of aggregate by weight" and "water-cement ratio 0.90" is found to correspond to 7 bags of cement per cubic yard of concrete in place.

3. Assuming in problem 1 that the specific gravity of the aggregate had been 2.65 instead of 2.69, would this make a change in the parts of aggregate by weight to one part of cement by weight?

Yes. The parts of aggregate to one part of cement by weight would change and be equal to $\frac{2.65}{2.69} \times 5.75$ or 5.66

4. Assuming in problem 1 that the relative consistency of the concrete mix would have been 120 instead of 100, what changes would this make in the parts of aggregate by weight to one part of cement by weight, water-cement ratio and gallons of water per bag of cement?

Referring to Diagram 1, the intersection of the lines "6 bags of cement" and "fineness modulus 5.50" is first found. Tracing vertically downwards from the intersection of said lines to line of "relative consistency 100" it is found that the gallons of water per bag of cement for a relative consistency of 100 is approximately 6. Then tracing downwards to the right, this corresponds to 7.2 gallons of water per bag of cement for a relative consistency of 120, and tracing vertically upwards we find that the equivalent water-cement ratio is 0.96. Tracing vertically upwards along the line of "water-cement ratio 0.96" until it intersects the line "6 bags of cement per cubic yard of concrete in place," and tracing horizontally to the left from this intersection it is found that the parts of aggregate by weight to 1 part of cement by weight is 1 to 5.55.

Some Practical Formulas

To determine percentage of dry, fine and coarse aggregate by weight or volume for a certain mix when the fineness modulus of the fine, coarse aggregate and mixed aggregate are known use

FORMULA 1. $p = 100 \frac{A - B}{A - C}$

Notations: p = percentage by weight or volume of fine aggregate in the mixed aggregate.
A = fineness modulus of coarse aggregate.
B = fineness modulus of mixed aggregate.
C = fineness modulus of fine aggregate. The percentage by weight or volume of coarse aggregate in the mixture is equal to 100—p.

To determine the volume of a batch of concrete in place made from one bag of cement when water-cement ratio, weights of fine and coarse aggregate in mix and specific gravity of aggregates are known, use Formula 2.

TABLE No. 6

Equivalent weights and quantities of water corresponding to varying percentages by weight of free water in 100 lbs. of aggregate

Water per cent by weight of aggregate	Per 100 lbs. aggregate	
	Weight in pounds	Gallons
0.5	0.5	0.06
1.0	1.0	0.12
1.5	1.5	0.18
2.0	2.0	0.24
2.5	2.5	0.30
3.0	3.0	0.36
3.5	3.5	0.42
4.0	4.0	0.48
4.5	4.5	0.54
5.0	5.0	0.60
5.5	5.5	0.66
6.0	6.0	0.72
6.5	6.5	0.78
7.0	7.0	0.84
7.5	7.5	0.90
8.0	8.0	0.96
8.5	8.5	1.02
9.0	9.0	1.08
9.5	9.5	1.14
10.0	10.0	1.20

The approximate quantity of free water carried by average aggregates, expressed in percentage by weight of aggregate is approximately as follows.

Moist sand	2%
Moderately wet sand	4%
Very wet sand	6% to 10%
Moist gravel or rock	2%
Wet gravel or rock	3% to 5%

The absorption of average aggregates, expressed in percentage by weight of aggregate is approximately as follows:

Average sand	1%
Gravel or crushed rock	1%
Granite and trap rock	0.5%
Porous sandstone	5% to 8%

FORMULA 2. $V = 0.50 + X + \dfrac{W_s}{62.5\ S_s} + \dfrac{W_r}{62.5\ S_r}$

For aggregates of average specific gravity Formula 2 can be reduced to the following simple form:

FORMULA 3. $V = 0.50 + X + \dfrac{W_s + W_r}{168}$

Notations used in Formula 2 and 3:

V = Volume of concrete to each bag of cement.
X = water-cement ratio.
W_s = weight of fine aggregate (sand or screenings) in pounds to each bag of cement in the mix.
W_r = weight of coarse aggregate (rock or gravel) in pounds to each bag of cement in the mix.

TABLE NO. 7

Total weight of fine and coarse aggregate required to one bag of cement (weighing 94 lbs.) for various values of water cement ratio and bags of cement per cubic yard of concrete in place

Water cement ratio $\frac{W}{C}$	Bags of cement per cubic yard of concrete in place.						
	4	4 1/2	5	5 1/2	6	6 1/2	7
0.60					571	512	464
0.63					566	507	459
0.67				629	560	501	453
0.70				623	554	495.	447
0.74			700	618	549	490	442
0.77			694	612	543	484	436
0.80		790	688	606	537	478	430
0.83		785	683	601	532	473	425
0.87		779	677	595	526	467	419
0.90	899	773	671	589	520	461	413
0.93	894	768	666	584	515	456	408
0.96	888	762	660	578	509	450	402
1.00	882	756	654	572	503	444	396
1.03	877	751	649	567	498		
1.07	871	745	643	561	492		
1.10	865	739	637	555	486		
1.14	860	734	632	550			
1.17	854	728	626	The values in Table 7 were determined from Formula 3, and are based upon an average specific gravity of 2.69 of fine and coarse aggregate, or a weight of 168 pounds per cubic foot of solid materials.			
1.20	848	722	620				
1.23	843	717	615				
1.27	837	711	609				
1.30	831	705	603				
1.33	826	700					
1.36	820	694					
1.40	814	688					
1.43	809	683					
1.46	803						
1.49	797						
1.57	798						

S_s = apparent specific gravity of fine aggregate.
S_r = apparent specific gravity of coarse aggregate.

To determine the weight of dry aggregates having a specific gravity different than given in Table 7, namely 2.69, use the following formula:

FORMULA 4. $W_1 = \dfrac{SpGr_1}{2.69} \times W$

Notations:
W = weight of dry aggregates given in Table 3
W_1 = weight of dry aggregates to be determined
$SpGr_1$ = specific gravity of aggregates of which the weight is to be determined.

* * *

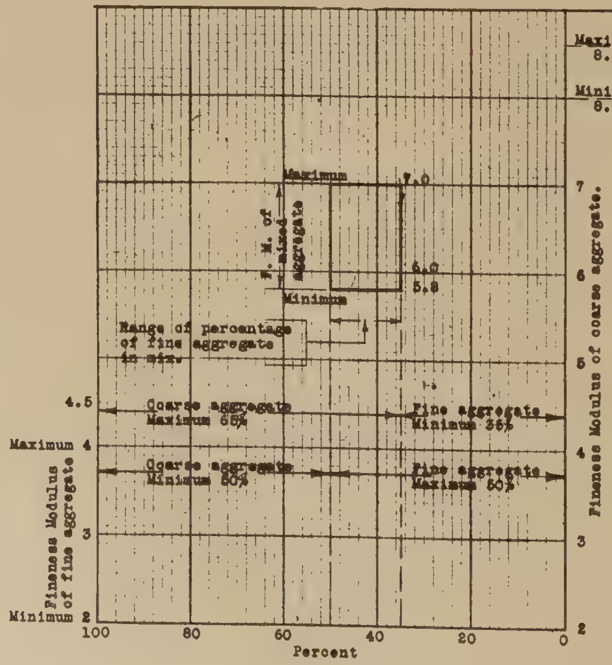
Diagrams for Determining the Minimum and Maximum Values of Fineness Moduli of Fine, Coarse and Mixed Aggregates and the Percentages of Fine and Coarse Aggregate for a Given Fineness Modulus, Size and Grading of Mixed Aggregate, That Will Produce the Best Results for Concrete Mixes

The value of any fineness modulus of mixed aggregate as determined from Diagrams 2, 3, 4 or 5, must lie within the area of the rectangle on the respective diagrams. All the values of these diagrams are based upon fine aggregate (sand or stone screenings) graded from 0 to ⅜ in., and coarse aggregate (gravel or crushed rock) graded from ⅜ in. to maximum size.

If the fine aggregate is graded from 0 to No. 4 and the coarse aggregate from No. 4 to maximum size, the value of the fineness modulus of mixed aggregate must lie between the limits of minimum and maximum fineness modulus of mixed aggregate indicated on the diagrams, and between the minimum and maximum percentages of fine aggregate as given in Table 8. For these sizes and gradings of fine and coarse aggregate, the value of minimum

DIAGRAM 2

Grading of mixed aggregate 0 to 3 in.



fineness modulus of coarse aggregate shall be that given in Table 8, corresponding to the size and grading of mixed aggregate.

DIAGRAM 3

Grading of mixed aggregate 0 to 2 in.

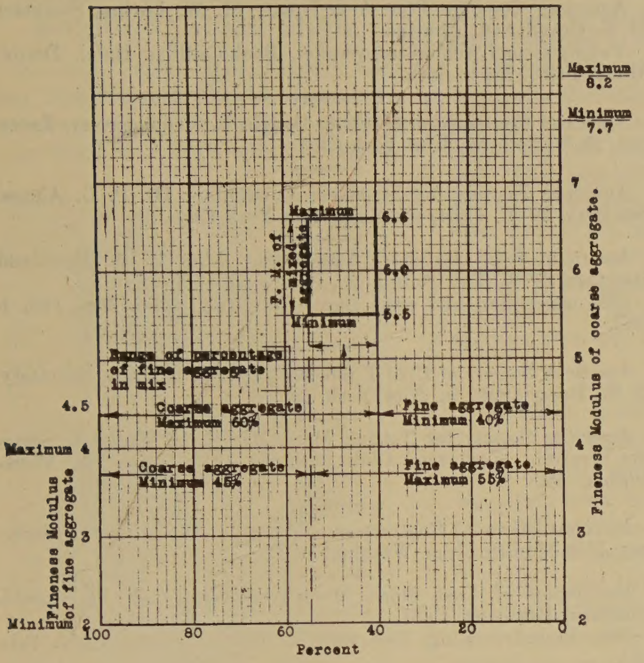


DIAGRAM 4

Grading of mixed aggregate 0 to 1½ in.

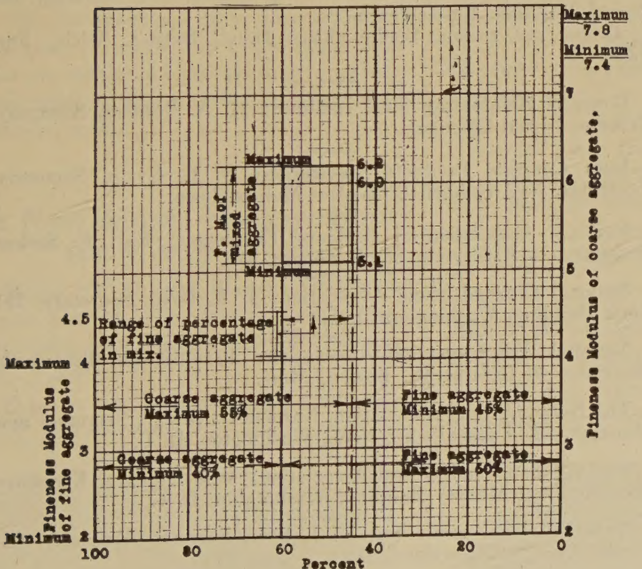
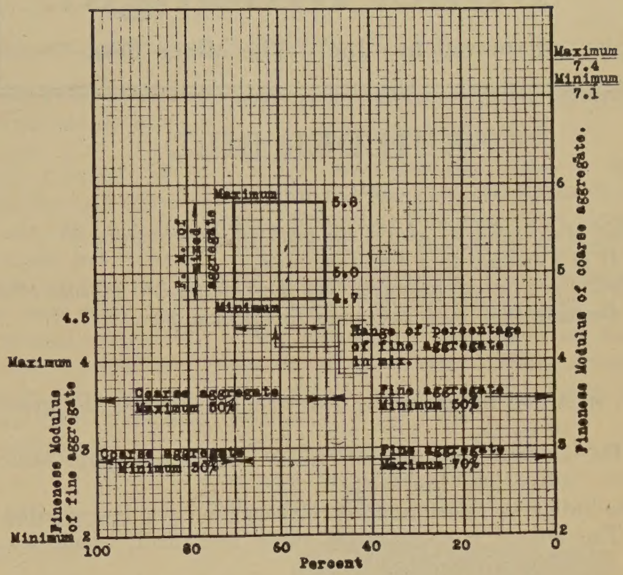


TABLE 8

Diagram No.	Size and grading of mixed aggregate.	Percentage of fine aggregate graded 0 to No. 4		Minimum fineness modulus of coarse aggregate.
		Minimum.	Maximum	
1	0 to 3 inch	25%	35%	7.70
2	0 to 2 inch	30%	40%	7.40
3	0 to 1½ inch	35%	45%	7.10
4	0 to 1 inch	40%	55%	6.80

DIAGRAM 5

Grading of mixed aggregate 0 to 1 in.



West Palm Beach Adopts Uniform Building Code

West Palm Beach is the first Florida city to adopt the proposed uniform building code which has been in course of preparation for the past two years by a committee representing the Florida Building Officials' Conference.

The code was adopted by the city commissioners of West Palm Beach on October 23rd, a month before the annual meeting at which the sponsors of the uniform code completed their work. Because of the emergency created by the destructive hurricane that swept West Palm Beach and vicinity on September 16th, the city officials wanted modern building regulations at once in order to control reconstruction. They accordingly communicated with officers of the Florida Building Officials' Conference and obtained their co-operation toward getting the uniform code into shape for adoption.

The uniform code has been available since August 1st, 1928, in preliminary draft, and in the light of several constructive criticisms received it was possible to anticipate the more importance changes to be made in the final draft. Several copies of the preliminary draft were edited accordingly, and accepted by the city in that form.

The proposed uniform building code for cities of Florida is patterned after the well-known Pacific Coast uniform code. Like the Pacific Coast document, it includes the recommendations of the Building Code Committee of the U. S. Department of Commerce. The chapter on reinforced concrete is taken from the American Concrete Institute's Tentative Building Regulations for Reinforced Concrete.

L. F. Fletcher, building commissioner of Orlando, has been president of the Florida Building Officials' Conference since the formation of that organization in 1926. The building code committee has co-operated to the fullest extent with the Board of Supervising Architects of the Florida Hotel Commission and with engineering and architectural societies of that state. In their completed building code they have a document well suited to the needs of the twenty-one cities represented in the membership of the Conference. It is reported that Palm Beach and Lake Worth are among other cities where steps have been taken toward adoption of the uniform code.

Mixer Musings

Reported by "Joe"—The Mixer Boss.

BUILDER BILL

(PROLOGUE)

This is no song of glory, no pean of heroes bold
It is a tribute to a breed of men.
Their's are heroic moments but their deeds are seldom told
Because they lack the hand to wield a pen.

He stretched the gleaming railroad lines across the green of earth,
He worked and fought when stars grew pale—who visualized his worth?
The bulwarks raised against the sea, the river levees piled,
The waters spanned with stone and steel,—each was once his child.
He passed you on the crowded street, so clannish, silent, still
That you labeled him a roughneck but his name was *Builder Bill.*

The tiny mite on toothpick steel, black outlined 'gainst the sky,
The mole that in the caissons digs, they do not fear to die.
That bearded tough by jungle marked is bringing in the line
Of water from the mountain cool. He left the world behind.
He burrows under crowded streets, he broils on desert grills,
And dawn oft finds him toiling on,—one of the *Builder Bills.*

That smooth expanse o'er which you drive should credit give to him.
The tower rising toward the stars, that obelisk so slim,
The mansion in its veil of trees, the clubhouse on the bay,
The building straight and slim and tall, the pool where children play—
These are his works. They knew him in his youth's heat and age's chill
And standing still are monuments to one dead. *Builder Bill.*

PAT O'LEARY,
(Supt., W. T. Hadlow)

And still they say construction men have no appreciation of poetry!

SLUMP TESTERS, ATTENTION!

Let's see how many Slump Testers will be at the A. C. I. meeting in February. As you meet your friends there, try to find out if they belong to this select group. Don't ask them bluntly, but feel them out carefully and slyly. Such an honor is not won lightly nor is it blazoned forth to the vulgar. No! Nor does a true Slump Tester speak of his sacred duties to anyone who has not undergone the "trial by water." So take heed!

Joe, the Mixer Boss.

Organizations

American Concrete Institute; **Harvey Whipple, Secretary,** 2970 West Grand Blvd., Detroit, Michigan.
Twenty-fifth annual convention, Book-Cadillac hotel, Detroit, Mich., Feb. 12th to 14th.

American Concrete Pipe Association; **M. W. Loving, Secretary,** 33 W. Grand Ave., Chicago.
Twenty-second annual convention, Book-Cadillac Hotel, Detroit, Mich., Feb. 14th to 16th.

American Construction Council; **Dwight L. Hoopingarner, Executive,** 28 W. 44th St., New York City.

American Engineering Standards Committee; **Dr. P. G. Agnew,** Secretary, 29 W. Thirty-ninth St., New York City.

American Road Builders' Association; **Miss E. A. Birchland,** Secretary, 29 W. Thirty-ninth St., New York City.
1929 convention and road show, Cleveland, Ohio, Jan. 14th to 19th.

American Society of Civil Engineers; **Geo. T. Seabury, Secretary,** 33 W. Thirty-ninth St., New York City.

American Society for Testing Materials; **C. L. Warwick,** Secretary-Treasurer, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

Associated General Contractors of America; D. H. Sawyer, Secretary, 1150 Munsey Bldg., Washington, D. C.

Association of Cast Stone Manufacturers; Frank M. Brooks, Secretary, Pasadena, Calif.
First annual meeting, Book-Cadillac Hotel, Detroit, Mich., Feb. 13th.

Building Officials Conference of America; Col. John W. Oehmann, Secretary, 1253 Lawrence St., N. E., Washington, D. C.

Concrete Products Association; F. O. Matthiessen, Secretary, 644 Drexel Building, Philadelphia, Pa.
Annual convention, Book-Cadillac Hotel, Detroit, Mich., Feb. 13th.

Concrete Reinforcing Steel Institute; **M. A. Beeman, Secretary,** Tribune Tower, Chicago.

Iowa Concrete Products Association; **R. L. Gavin,** Secretary-Treasurer, 1002 Hubbell Bldg., Des Moines, Iowa.

National Association of Builders' Exchanges; **Earl F. Stokes,** Secretary, 15 E. Fayette St., Baltimore, Md.

National Crushed Stone Association; **J. R. Boyd, Secretary,** 751 Earle Building, Washington, D. C.

National Fire Protection Association; **Franklin H. Wentworth,** Secretary, 40 Central St., Boston, Mass.

The National Lime Association, **Norman G. Hough, Secretary and** Manager, 927 Fifteenth St., N.W., Washington, D. C.

National Sand and Gravel Association; **V. P. Ahearn, Executive** Secretary, 432 Munsey Building, Washington, D. C.

National Slag Association; **H. J. Love, Secretary-Treasurer,** 937 Leader Building, Cleveland, Ohio.

Northwest Concrete Products Association; **F. R. Zaugg, Executive** Secretary, 803 Seaboard Building, Seattle, Wash.
Fourth annual convention, Eugene Hotel, Eugene, Oregon, Jan. 25th and 26th.

Ohio Concrete Products Association; **G. M. Friel, Secretary-**Treasurer, 2284 North High St., Columbus, Ohio.

Portland Cement Association; **William M. Kinney, General Man**ager, 33 W. Grand Ave., Chicago.

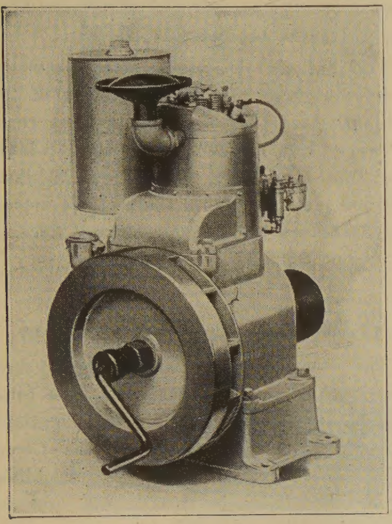
Rail Steel Bar Association; **H. P. Bigler, Engineering Secretary,** Builders' Building, 228 N. La Salle St., Chicago, Ill.

Wisconsin Concrete Products Association; **Jack Franklin, Secre**tary-Treasurer, 3115 Plankinton Arcade, Milwaukee, Wisconsin.
Annual Convention, Plankinton Hotel, Milwaukee, Jan. 10th and 11th.

New Equipment and Materials

Lauson to Exhibit New Engine at Road Show

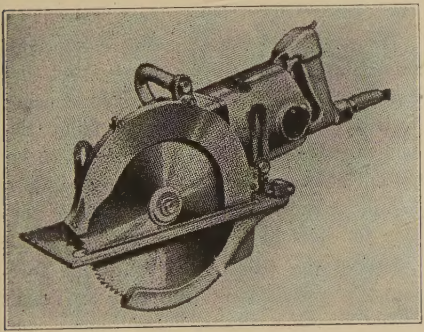
The John Lauson Manufacturing Company, New Holstein, Wis., has developed a new vertical engine in time for exhibition at the Road Show at Cleveland in January. It is air-cooled and built on automotive lines.



The manufacturer states that it is not too heavy in weight and has working parts that are substantial enough to give continuous service. Its applicability to portable units is stressed.

A New Model Skilsaw Built for Heavy Work

Model "O" Skilsaw, illustrated below, is a new addition to the line of portable electric hand saws manufactured by Skilsaw, Inc., Chicago, Illinois.



This saw was created primarily for heavy work that requires a greater cutting capacity. It will cut any wood up to 3¾ in. in one cut, according to the manufacturer. Model "O" is a light, sturdy tool, weighing 24 lbs. It cross-cuts, rips, grooves and bevels anywhere on the job, inside or outside. Besides cutting wood, it can be used to cut other building material such as limestone, concrete, asbestos, etc.

One important feature of Model "O" Skilsaw is the wide adjustable and tilting base for bevel or mitre cuts. Any kind of a roof, hip jack rafters, cripple jack rafters and valley jack rafters of a regular roof, can be cut with the base tilted at 45 deg., even though 2-in. rough lumber is used, it is claimed. Another feature is the approved safety guard which fully protects the operator from the saw blade. Skilsaw operates from any electric light socket.

Outfit Clears Pavement Cracks for Tar

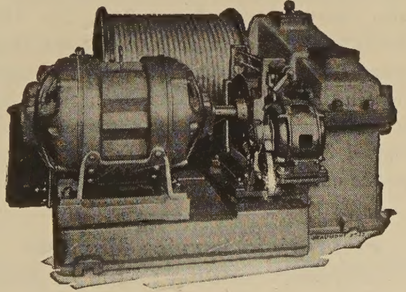
For cleaning dirt from cracks in pavement before tar is poured, the Novo Engine Company has designed and built a small blower outfit.

The first unit manufactured was recently put into operation by the city of Lansing, Michigan. In this instance the outfit attended by one operator is said to have accomplished as much as two sweepers and to have done better work. This outfit was used later also for blowing water from expansion joints and on other similar jobs.

It consists of a Novo Model GU 2-h.p. single cylinder, hopper cooled, roller bearing engine direct connected through two to one gearing to a No. 17 Connersville blower. The complete outfit is mounted on a channel frame truck, with welded tubular spreaders. The blower has a discharge of 35 cu. ft. per minute. To provide proper pressure an ordinary garden nozzle is attached to one end of the hose.

Beaumont Makes New Skip Hoist Winding Machine

Several new features have been included in a skip hoist winding machine now being produced and placed on the market by the R. H. Beaumont Company, Philadelphia, Pennsylvania.



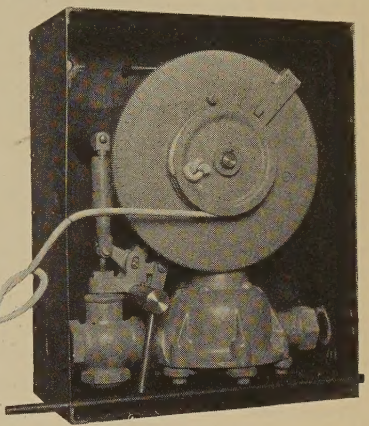
The machine is reputed to be compact and durable, employing the highest grade rubber bearings, with resultant long life and quiet operation.

Automatic Meter New Water Control Device

A new water-measuring device is that offered by the Automatic Meter Sales Company, Milwaukee, Wis., and known as the Automatic meter. The device consists of a water meter connected to a graduated dial calibrated in one-quarter gallons.

The manufacturer emphasizes the fact that the amount of water passing through the meter is not affected by variation in pressure.

The operation consists of setting the dial to give the desired amount of water into the batch. Then, if desired, the unit may be locked, to eliminate the possibility of tampering. To start the flow, the operator pulls the cable which opens the valve and at the same time pulls the dial around to the position set. No further attention by the operator is then required, for after the required amount of water has passed through the meter it automatically stops itself.



To the dial is also connected a register that records each batch. This makes it possible to take a reading at the end of the day of the total number of batches made, eliminating the necessity of counting the empty bags.

The units are made in two sizes—30 and 60 gallons.

On mixers using skip loaders, the entire operation can be made automatic, according to the manufacturer, by connecting the unit to the loader.

New Koehring Paver Model

The Koehring Company, Milwaukee, Wis., will announce shortly a new Koehring 27-E heavy duty paver, said to be new in principle and design and embodying advanced paving mixer requirements.

The model will replace the present 27-E paver, whose manufacture and sale has been discontinued.

About Makers of Equipment and Materials

NOTES FROM THE FIELD

National Equipment Corp. Absorbs

Philip A. Koehring, president of the *National Equipment Corp.*, has made announcement of the acquisition of the *Parsons Co.*, Newton, Ia., manufacturers of power trench excavators, and the *Insley Mfg. Co.*, of Indianapolis, Ind., manufacturers of steel towers for hoisting and pouring concrete.

Both companies will continue under their present management as divisions of the National Equipment Corp. H. C. McCardell, president of the Parsons Co., and W. H. Insley, president of the Insley Mfg. Co., become vice-presidents and directors of the parent corporation.

The corporation now owns four member companies—Koehring Company, T. L. Smith Company, Insley and Parsons, with total assets of $9,000,000 and 1928 sales close to $10,000,000.

The officers and directors of the National Equipment Corp. include the following: Philip A. Koehring, president and treasurer; W. J. Koehring, W. H. Insley, Harold E. Smith and H. C. McCardell, vice-presidents; W. J. Zimmer, secretary; J. E. Uihlein, R. A. Uihlein, Willits Pollock and J. W. Kieckhefer, directors.

The National Equipment Corporation was organized in 1927 by Philip A. Koehring and associates, to acquire the ownership of companies manufacturing construction machinery, and is expanding along lines very similar to the original expansion program of General Motors. The divisions of National Equipment are operated as independent units, with close co-operation in engineering matters, standardization of production methods, warehousing, service and other angles.

Headquarters of National Equipment are located in Milwaukee, where are also the T. L. Smith and Koehring plants.

Koehring Co. was organized in 1906 with an original investment of $15,000 by Wm. J. Koehring, Philip A. Koehring and Richard Kiel, who are still its principal officers. It manufactures a broad line of concrete mixers, paving machines, power shovels, cranes and draglines. Its growth during the last ten years has been rapid, sales having increased from $686,642 in 1917 to $5,542,998 in 1927, and are estimated at $6,000,000 for 1928.

Philip A. Koehring, who is general manager of Koehring Company and president of National Equipment Corp., has been twice president of the Milwaukee Association of Commerce and president of the National Association of Concrete Mixer Manufacturers.

The T. L. Smith Company was started by T. L. Smith in 1900, in which year he brought out his first tilting drum concrete mixer. The T. L. Smith Company is said to have produced the largest mixers in the history of the world, capable of mixing four tons of concrete in one batch. The business for some years has been under the management of Harold E. Smith, who is a director and a vice-president of National Equipment Corp.

The W. H. Insley Mfg. Co. has been developed by Mr. Insley from a steel fabricating and jobbing business, which is now one of the departments of the company's activities. Four years ago Mr. Insley introduced a ½-yd. shovel and crane to his line, in which he has had sales of close to $1,000,000 during each of the last two years. This shovel is complementary to the line of larger machines made by Koehring Co.

The Parsons Company was founded by Geo. Parsons, an engineer and inventor. Upon his retirement from the company, his interest was purchased by H. C. McCardell, who has for some years been president and general manager, and owned a controlling interest in the Parsons Co.'s common stock.

Road Grader Combine

The Ryan Manufacturing Corp., Chicago, Ill., and the *C. D. Edwards Manufacturing Company*, of Albert Lea, Minn., have announced the consolidation of sales organizations, effective since November 1st. It is understood that this looks forward to the eventual consolidation of manufacture and other activities of the two companies.

Roger D. Edwards, heretofore secretary and treasurer of the Edwards Co., has been elected vice-president of that company and also vice-president of the Ryan Co. He will direct the sales activities of the two corporations, which now have representation in thirty states of the Union and contemplate full representation throughout the United States. Other changes in the corporate officers will be announced later.

Penn-Dixie Service Manager

The Pennylvania-Dixie Cement Corporation has appointed *J. H. Chubb* manager of its service bureau at New York City.

Mr. Chubb, a graduate civil engineer, has had over twenty years' experience in observing the results obtained with and advising concerning the proper use of portland cement and concrete in all classes of construction work.

INDUSTRIAL LITERATURE

Incor Publication

"Saving 760,000 Detours with 'Incor'" is the attention-pulling caption of a new *International Cement Corporation* publication of four pages, devoted to the new high early strength product.

The bulletin derives its title from the chief and first item—a description of the 24-hour paving of the Boston Post road, between New York and Boston, where, had the road been closed for 28 days, 800,000 detours would have been necessary, whereas the 24-hour closing necessitated but 40,000.

Overhead Sand Distribution

The Cleveland tramrail overhead sand distributing system is described in a four-page folder published by the *Cleveland Electric Tramrail division* of the *Cleveland Crane and Engineering Co.*, Wickliffe, Ohio. Selectivity in distributing and reduced handling costs are featured.

Vibrolithic Corporation

Enclosed in a somewhat more elaborate cover than the previous edition and revised to bring it up to date, a new edition of the publication *"Vibrolithic Pavements"* is now being distributed by the *American Vibrolithic Corporation*, Des Moines, Iowa.

Waterproofing and Strengthening Agent

A bulletin presenting some properties of a product known as *Aquagel*, for plasticizing, waterproofing and strengthening concrete are presented in a 16-page publication issued by the *Silica Products Company*, Kansas City, Mo.

The method of incorporating it into concrete and its action when used are described. The most convenient way of using it, however, is said to be to employ the cement into which Aquagel has been ground at the mill. This cement is known as Plastic King portland, and sixteen reasons for its added convenience are given.

Beyond the pages devoted to the foregoing, the following subjects are dealt with: Strength Plastic King cement, use of Aquagel in mortar, recommended Aquagel masonry cement, Aquagel light-weight concrete, Aquagel for central mixing plants. Two tables, one on the water-cement ratio law and the other on quantity of materials for concrete, are found on the last pages.